Comparison between Dexmedetomidine and a combination of Midazolam and Fentanyl for sedation during awake fiberoptic intubation – a prospective randomized parallel group double-blinded study

Dissertation submitted in partial fulfilment

of the requirements for the degree

M.D. (Anaesthesiology)

BRANCH - X

DEPARMENT OF ANAESTHESIOLOGY & CRITICAL CARE

TIRUNELVELI MEDICAL COLLEGE

TIRUNELVELI – 627 011

THE TAMIL NADU

Dr. M.G.R. MEDICAL UNIVERSITY

CHENNAI

APRIL 2016

BONAFIDE CERTIFICATE

This is to certify that the work embodied in this dissertation entitled **"COMPARISON BETWEEN DEXMEDETOMIDINE AND A COMBINATION OF MIDAZOLAM AND FENTANYL FOR SEDATION DURING AWAKE FIBEROPTIC INTUBATION – A PROSPECTIVE RANDOMIZED PARALLEL GROUP DOUBLE-BLINDED STUDY"** has been carried out by **Dr.T.Srikandan, M.B.B.S, M.D(Anaesthesiology),** a Post Graduate student under my supervision and guidance for his study leading to Branch X M.D. Degree in Anaesthesiology during the period of March 2014 to December 2014

DEAN
Tirunelveli Medical College &
Hospital
Tirunelveli-11

Date:

Professor and HOD
Department of Anaesthesiology
Tirunelveli Medical College
Tirunelveli-11

Date:

DECLARATION

I, Dr.T.Srikandan, solemnly declare that this dissertation titled **“COMPARISON BETWEEN DEXMEDETOMIDINE AND A COMBINATION OF MIDAZOLAM AND FENTANYL FOR SEDATION DURING AWAKE FIBEROPTIC INTUBATION – A PROSPECTIVE RANDOMIZED PARALLEL GROUP DOUBLE BLINDED STUDY”** is the bonafide work done by me under the expert guidance and supervision of Dr.A.Balakrishnan, Professor and HOD , Department of anaesthesiology & Critical care , Tirunelveli medical college, Tirunelveli– 11.

This dissertation is submitted to The Tamil Nadu Dr. M.G.R Medical University towards partial fulfilment of requirement for the award of M.D., Degree (Branch X) in Anaesthesiology

Place: **Dr. T.SRIKANDAN**

Date:

ACKNOWLEDGEMENT

I am greatly obliged to the Dean, **Dr.SithyAthiyaMunavarah M.D,** Tirunelveli Medical College Hospital for allowing me to conduct this study.

I sincerely thank my HOD **Dr.A.Balakrishnan,M.D,** Department of anaesthesiology Tirunelveli Medical College, Tirunelveli-627011 for his constant encouragement and help to conduct this study.

I immensely thank my Associate Professors **Dr.R.AmuthaRani M.D, Dr.R.Selvarajan M.D, Dr.E.EbenezerJoelKumar,MD, DNB**, for their constant interest and guidance in bringing out this dissertation.

I am greatly indebted to my guide **Dr.G.Vijayanand M.D**. for his inspiration, guidance, and comments on all stages of this study.

I thank all my Assistant Professors and Senior Residents in the Department of Anaesthesiology for their constant support and encouragement.

I would like to express my heartfelt gratitude to my esteemed Former Professor & HOD **Dr.A.Thavamani M.D**, **D.A**, who has been a constant source of inspiration and encouragement.

I immensely thank **Dr.Maheshwari M.S**, Professor & HOD , Department of surgery, Tirunelveli Medical College, Tirunelveli - 627011 and **Dr.Elangovan**

chellappa M.S, Professor & HOD , Department of orthopaedics , Tirunelveli medical college , Tirunelveli **-** 627011 for providing me the cases to perform the study

I thank all my colleagues for helping me to do this dissertation

I also thank all the patients, for submitting themselves willingly for this study.

TIRUNELVELI MEDICAL COLLEGE

INSTITUTIONAL RESEARCH ETHICS COMMITTEE
TIRUNELVELI, STATE OF TAMILNADU, SOUTH INDIA PIN 627011
91-462-2572733-EXT; 91-462-2572944; 91-462-2579785; 91-462-2572611-16
online@tvmc.ac.in, tirec@tvmc.ac.in; www.tvmc.ac.in

CERTIFICATE OF REGISTRATION & APPROVAL OF THE TIREC REF NO: 493/ANAES/2014/43

PROTOCOL TITLE: A Comparison of Dexmedetomidine with a combination of Midazolam and Fentanyl fo sedation during awake fibreoptic intubation – a prospective, randomized, double-blinded study.

NAME OF PRINCIPAL INVESTIGATOR: Dr. Srikandan
DESIGNATION OF PRINCIPAL INVESTIGATOR: Post Graduate in MD., Anaesthesia
DEPARTMENT & INSTITUTION: Department of Anaestheisology, Tirunelveli Medical College

Dear Dr. Srikandan , *The Tirunelveli Medical College Institutional Ethics Committee (TIREC) reviewed and discussed your application during the IEC meeting held on 28.12.13.*

THE FOLLOWING DOCUMENTS WERE REVIEWED AND APPROVED

1. TIREC Application Form ☑
2. Study Protocol ☑
3. Department Research Committee Approval ☑
4. Patient Information Document and Consent Form in English and Vernacular Language ☐
5. Investigator's Brochure ☑
6. Proposed Methods for Patient Accrual Proposed ☑
7. Curriculum Vitae of the Principal Investigator ☐
8. Insurance /Compensation Policy ☐
9. Investigator's Agreement with Sponsor ☑
10. Investigator's Undertaking ☑
11. DCGI/DGFT approval ☐
12. Clinical Trial Agreement (CTA) ☑
13. Memorandum of Understanding (MOU)/Material Transfer Agreement (MTA) ☐
14. Clinical Trials Registry-India (CTRI) Registration ☐

THE PROTOCOL IS APPROVED IN ITS PRESENTED FORM ON THE FOLLOWING CONDITIONS

1. The approval is valid for a period of 2 year/s or duration of project whichever is later
2. The date of commencement of study should be informed
3. A written request should be submitted 3weeks before for renewal / extension of the validity
4. An annual status report should be submitted.
5. The TIREC will monitor the study
6. At the time of PI's retirement/leaving the institute, the study responsibility should be transferred to a person cleared by HOD
7. The PI should report to TIREC within 7 days of the occurrence of the SAE. If the SAE is Death, the Bioethics Cell should receive the SAE reporting form within 24 hours of the occurrence.
8. In the events of any protocol amendments, TIREC must be informed and the amendments should be highlighted in clear terms as follows:
   a. The exact alteration/amendment should be specified and indicated where the amendment occurred in the original project. (Page no. Clause no. etc.)
   b. The PI must comment how proposed amendment will affect the ongoing trial. Alteration in the budgetary status, staff requirement should be clearly indicated and the revised budget form should be submitted.
   c. If the amendments require a change in the consent form, the copy of revised Consent Form should be submitted to Ethics Committee for approval. If the amendment demands a re-look at the toxicity or side effects to patients, the same should be documented.
   d. If there are any amendments in the trial design, these must be incorporated in the protocol, and other study documents. These revised documents should be submitted for approval of the IEC, only then can they be implemented.
   e. Approval for amendment changes must be obtained prior to implementation of changes.
   f. The amendment is unlikely to be approved by the IEC unless all the above information is provided.
   g. Any deviation/violation/waiver in the protocol must be informed

STANDS APPROVED UNDER SEAL

Dr.K.Shantharaman MD
Registrar, TIREC
Tirunelveli Medical College, Tirunelveli – 627011
State of Tamilnadu, South India

TIRUNELVELI MEDICAL COLLEGE TAMIL NADU INDIA

Dr.V.Ramasubramanian MD DM
Member Secretary, TIREC
Tirunelveli Medical College, Tirunelveli – 627011
State of Tamilnadu, South India

The Tamil Nadu Dr.M.G.R.Medical... TNMGRMU EXAMINATIONS - DUE 30-...

Originality GradeMark PeerMark

Dissertation-FOB

BY 201220302.ANAESTHESIOLOGY SRIKANDAN .T

turnitin 9% SIMILAR -- OUT OF 0

INTRODUCTION

Fibreoptic nasotracheal intubation is one of the techniques available for the management of patients with difficult airways. Fibreoptic and video technologies are widely used for airway management at recent times. The term 'AFOI' is used to distinguish this procedure from fiberoptic intubation performed under general anesthesia.

Awake fiberoptic intubation (AFOI) is indicated for patients with anticipated difficult airways because of their anatomy, airway trauma, morbid obesity, and unstable cervical spine injuries. One challenge associated with this procedure is providing adequate sedation and anxiolysis while maintaining a patent airway and adequate ventilation, especially with difficult or critical airways. Optimal intubating condition with sedation and patient comfort are important factor and a great challenge for fiberoptic nasal intubation. Hence there is need for an ideal sedation regimen which would provide patient comfort, blunting of airway reflexes, patient cooperation, haemo-dynamic stability, amnesia and maintenance of a patent airway with spontaneous ventilation. The main goal of conscious sedation for the patient is that he has to be awake, calm and cooperative, following our verbal commands. Thus conscious sedation minimizes awareness of the procedure and improves patient satisfaction.

Various drugs may be available to carry out the procedure of which Midazolam , fentanyl combination is one among them . Midazolam at a dose of 40 mcg/kg provides adequate sedation, anxiolysis and amnesia for the patient. Fentanyl at

Match Overview

1	medind.nic.in	Internet source	3%
2	Singh, Praneet, T Puni...	Publication	1%
3	sedacionweb2.com	Internet source	1%
4	www.druglib.com	Internet source	1%
5	ivyleaguenurse.com	Internet source	<1%
6	Shen, She-Liang, Yi-h...	Publication	<1%
7	Bergese, S.D.. "A com...	Publication	<1%
8	Andreas E Trittsch. Cri...	Publication	<1%
9	&NA;. . "IARS 2012 An...	Publication	<1%
10	Submitted to Kaohsiun...	Student paper	<1%

PAGE: 1 OF 78

Text-Only Report

INDEX

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

AFOI – Awake fiberoptic intubation

SBP – Systolic blood pressure

DBP – Diastolic blood pressure

MAP – Mean arterial pressure

MPC – Mallampatti class

TMD – Thyromental distance

ABSTRACT

OBJECTIVES :

Primary outcome:

To determine the optimal comfort and co-operation among the patients for Awake fiberoptic intubation procedural sedation.

Secondary outcome:

Ease of intubation, intubation time, sedation scale, comfort scores and hemodynamic variables.

DESIGN :

Single centre, prospective, randomized, parallel group, double blinded Study.

SETTING :

Department of Anaesthesiology, Tirunelveli Medical College, Tirunelveli.

SUBJECT :

40 patients of both sexes in the age group of 25 to 50 belonging to ASA I and II status undergoing thyroid surgery.

METHODS :

After randomization and masking all the subjects in the group were subjected to premedicant Inj.Glycopyrrolate and topical anaesthesia for the airway . Group D received 1 mcg/kg of dexmedetomidine followed by an infusion of 0.7 mcg/kg/hr whereas group FM received 2 mcg/kg of fentanyl and 40 mcg/kg of midazolam.

MONITORING :

Patient was monitored for Vital parameters , sedation score based on Ramsay sedation scale , Comfort scores based on ambu et al scoring , intubation scores.

ANALYSIS & RESULTS :

After recording in the master sheet, data was analysed using SPSS software, Sigma stat 3.5 version by means of student t test, one way ANOVA and chi square test. Stastical significance existed between two groups in terms of intubation time ($P<0.001$), sedation scale ($P<0.005$), comfort scores ($P<0.001$), hemodynamic variables ($P<0.02$) and SPO_2 scores ($P<0.02$), with dexmedetomidine being the better drug among the two. Rest of the variables were comparable but not significant.

CONCLUSION :

Dexmedetomidine offered a good sedation, amnesia, anxiolysis, analgesia, shorter intubation time and a better hemodynamics avoiding respiratory depression when compared with fentanyl midazolam combination.

KEYWORDS :

Dexmedetomidine hydrochloride, intubation, fentanyl citrate, sedation, midazolam .

INTRODUCTION

Fiberoptic nasotracheal intubation is one of the techniques available for the management of patients with difficult airways. Fiberoptic and video technologies are widely used for airway management at recent times. The term ‘AFOI’ is used to distinguish this procedure from fiberoptic intubation performed under general anesthesia.

Awake fiberoptic intubation (AFOI) is indicated for patients with anticipated difficult airways because of their anatomy, airway trauma, morbid obesity, and unstable cervical spine injuries. One challenge associated with this procedure is providing adequate sedation and anxiolysis while maintaining a patent airway and adequate ventilation, especially with difficult or critical airways. Optimal intubating condition with sedation and patient comfort are important factor and a great challenge for fiberoptic nasal intubation. Hence there is need for an ideal sedation regimen which would provide patient comfort, blunting of airway reflexes, patient cooperation, haemo-dynamic stability, amnesia and maintenance of a patent airway with spontaneous ventilation. The main goal of conscious sedation for the patient is that he has to be awake, calm and cooperative, following our verbal commands. Thus conscious sedation minimizes awareness of the procedure and improves patient satisfaction.

Various drugs may be available to carry out the procedure of which midazolam, fentanyl combination is one among them. Midazolam at a dose of 40 mcg/ kg provides adequate sedation, anxiolysis and amnesia for the patient. Fentanyl at a dose of 2 mcg/kg relieves pain if any during the procedure and depresses airway reflexes which facilitate airway instrumentation. Unfortunately, this combination of drugs can cause respiratory depression, placing the patient at risk for hypoxemia and aspiration.

Dexmedetomidine however has several unique properties that make it ideally suited for the management of difficult airways. First, it provides an unique form of sedation in which patients appear to be sleepy but, if stimulated, are easily aroused, cooperative, and communicative. Second, dexmedetomidine has anxiolytic, amnestic, and moderate analgesic effects, as well as antisialagogue effects. Third, dexmedetomidine has a respiratory-escape effect, even when administered in large doses.

In view of the above said statements, we carried out a randomized study to investigate the better drug among the two groups for conducting awake fibreoptic intubation for which we chose to divide the patients into two groups, one receiving fentanyl midazolam combination, and the other one receiving dexmedetomidine. We aimed to derive a comprehensive and integrated picture of the relative safety and effectiveness of one drug over the other.

AIM & OBJECTIVE

AIM :

To compare the effectiveness and safety of dexmedetomidine with a combination of fentanyl and midazolam for procedural sedation during awake fibreoptic intubation.

OBJECTIVE:

Primary outcome:

To determine the optimal comfort and co-operation among the patients for AFOI procedural sedation.

Secondary outcome:

Ease of intubation, intubation time, sedation scale, comfort scores and hemodynamic variables.

REVIEW OF LITERATURE

Shah B.K et al [1] compared the efficacy of Dexmedetomidine with midazolam for sedating cardiac patients undergoing awake fibreoptic nasal intubation and they concluded that dexmedetomidine is more efficacious than midazolam by means of better hemodynamic support and comfort scores for AFOI.

Samia M. Masoud et al [2] studied Dexmedetomidine with

Conventionally used Propofol/Midazolam and Fentanyl/Midazolam combinations for conscious sedation during awake fibrotic intubation. They came to a conclusion that Dexmedetomidine was the better drug among the three providing better condition for the patient throughout the procedure satisfying their needs.

Tsai et al [3] compared the effectiveness of Dexmedetomidine with target controlled infusion of propofol for sedation during fibreoptic nasal intubation. They found dexmedetomidine by all means provided better comfort and safety to the patient than propofol group.

David cateno et al [4] carried out a randomized double blinded pilot study to compare the efficacy of dexmedetomidine with remifentanil for AFOI in a group of 30 patients after proper adequate topical anaesthesia and anxiolysis with 2 mg of midazolam. They came to a conclusion that dexmedetomidine is a better drug when compared with remifentanil for AFOI but dependent on dosage and time.

Sunil kumar sinha et al [5] conducted a study to compare

dexmedetomidine alone with dexmedetomidine & ketamine combination for awake nasal fibreoptic intubation in 60 adult patients in the age group of 20 to 60 years with

ASA I & II status posted for elective surgery under general anaesthesia. Patients were divided into two groups randomly and blinded along with investigator. It was concluded that dexmedetomidine ketamine combination offered better hemodynamic stability and sedation than dexmedetomidine alone.

Kumkum Gupta et al [6] conducted a randomized clinical trial involving 50 patients with temporo mandibular joint ankylosis with an aim of determining whether Dexmedetomidine can be used as a premedicant for awake nasal fibreoptic intubation. They concluded that fibreoptic intubation was easier when dexmedetomidine was given as a premedicant and also there was a better hemodynamic stability.

Xing yung he et al [7] conducted a clinical study using dexmedetomidine in patients undergoing AFOI and concluded that dexmedetomdine is a very useful adjunct for the same .

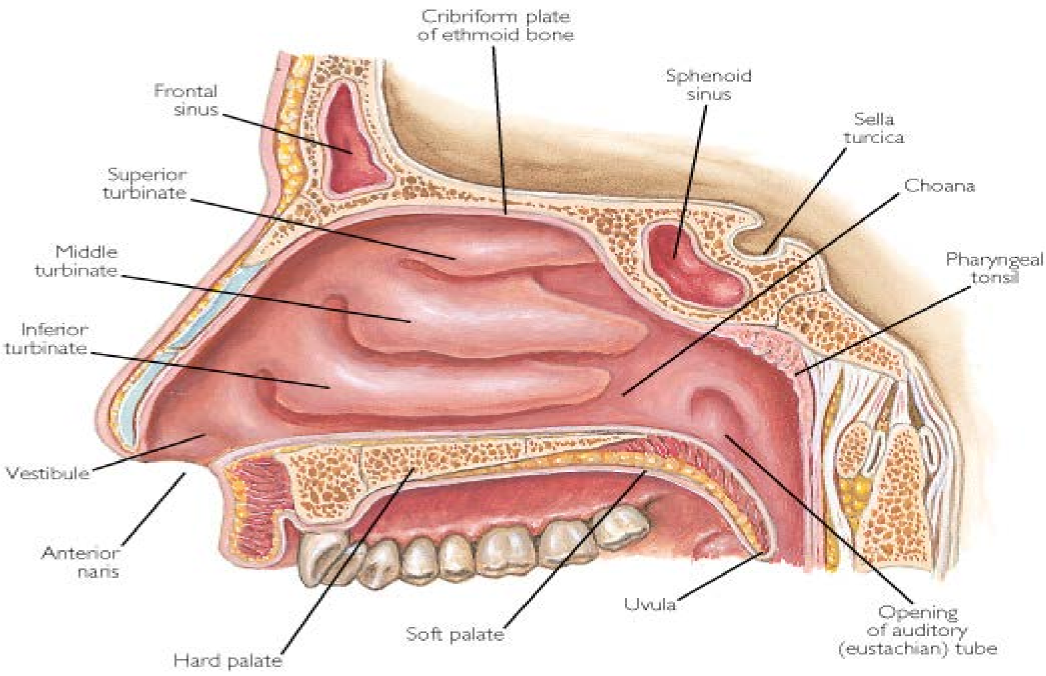
AIRWAY ANATOMY

The anatomy and physiology of the airway is one of the core topic in anaesthesia which needs a detailed discussion . Ribcage protects the complicated and delicate organ, lungs by safely encasing it for carrying out its very precise bodily functions. Airway, the passage commencing from the nostrils and ending at alveoli plays important functions which are very essential. We the anaesthesiologists work on this passage interfering with the normal homeostasis as a result of which we should give undue respect for it allowing it to carry out its normal physiologic functions.

Nasal sepum divides the nasal cavity into two halves and it consists of quadrilateral cartilage joining the vomer and ethmoid bone. On the anterior most part of nasal cavity lies the vestibule which is covered by hair and skin following which the nasal valves are present which seperates the nasal cavity from vestibule. Posterior most part of the nasal septum contains a strut called columella. The roof of nose is tent shaped whereas the floor runs in horizontal direction parallel to the hard palate The cribriform plate of ethmoid bone forms the middle third of roof of nose, on which lies the olfactory epithelium.

The surface area of nasal cavity is increased by three projecting shelves of bone, the superior, middle and inferior turbinates located on the lateral wall of nose. There is a potential space under these turbinates or concha called meatus and it is labelled as superior, middle and inferior respectively corresponding to their respective turbinates. Of the three meatus middle meatus plays an important role as all of the sinuses present in the nasal cavity opens into it except for the sphenoidal and posterior ethmoid cells which open into the superior meatus. The middle meatus with the sinuses opening into it forms the osteo-meatal complex which is an important area in the nose. Any mechanical interference in this area will affect the mucociliary clearance and ventilation of the sinuses. Patients who are intubated nasotracheally , receiving prolonged ventilation may end up with inflammation of sinuses resulting in chronic sinusitis if this issue is not addressed properly . Inferior meatus which is located just below the inferior concha receives the opening of nasolacrimal duct, the obstruction of which causes chronic dacrocystitis .

Figure 1 - Lateral wall of nose



Respiratory and olfactory epithelium constitutes the two type of epithelium which are present in the nose of which olfactory epithelium extends from the septum to superior turbinate on the superior part of nasal cavity. The epithelium is of nonciliated type and contains the bipolar olfactory cells, whose axons combine to form the olfactory bulbs which are twenty in number. Any damage to the cribriform plate results in shear loss of olfactory neurons ending up in loss of smell.

Coming to the second type of epithelium, the respiratory epithelium is of pseudostratified type occupying the rest of nasal cavity. Respiratory epithelium starts from the nasal cavity and continues to the rest of airway and hence any infection or inflammation in the nose and sinuses tends to spread on to the lower airway infecting trachea and bronchi too. Below the respiratory mucosa therelies the submucosa containing goblet cells and mucous glands.

Both internal and external carotid arteries supply the nose. Opthalmic artery, a branch of internal carotid artery divides into anterior and posterior ethmoidal artery and supplies the superior part of nose. Maxillary artery, a branch of external carotid artery supplies the rest of nose. Epistaxis commonly occurs on the anterior septum where Kiesselbach's plexus (Little's area) is situated. Both the ophthalmic and facial veins drain the nose into pterygoid and pharyngeal plexus. The drainage occurs both intracranially and extracranially.

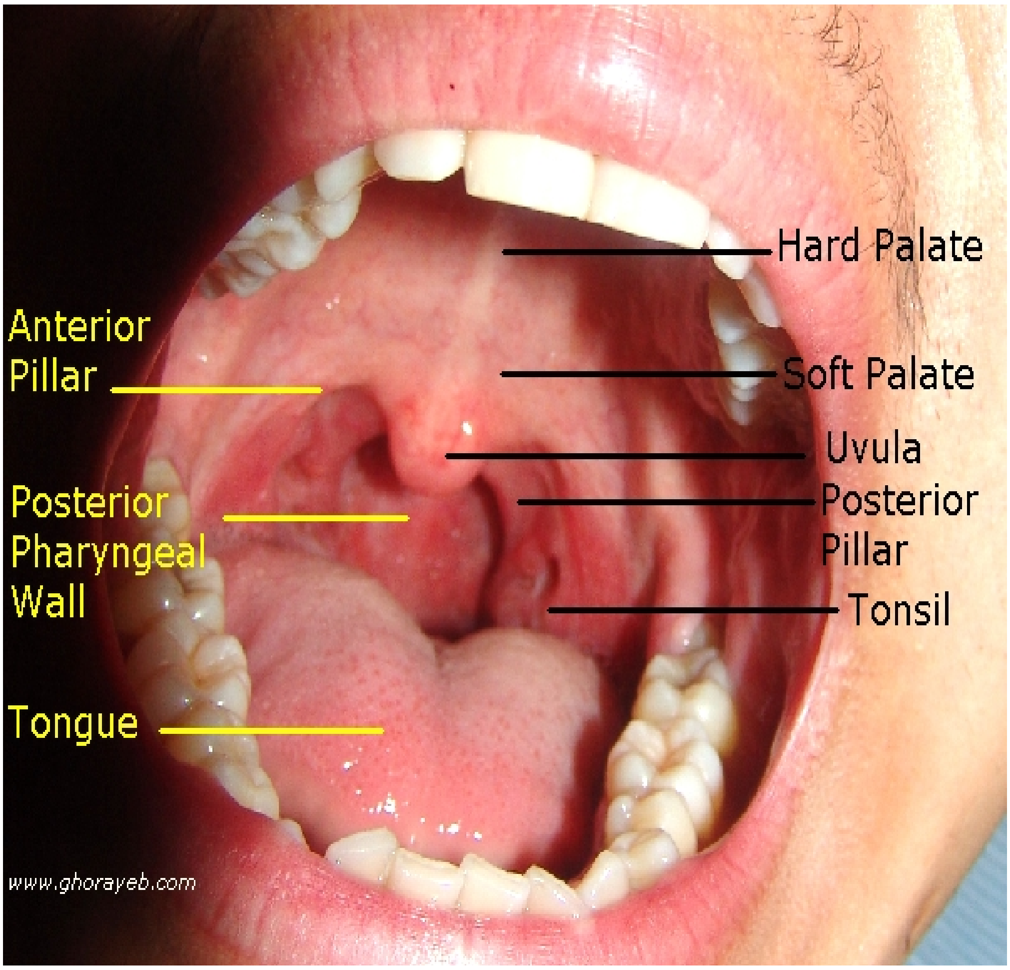
Nerve supply to the nose consists of autonomic, special sensory and sensory. First and second branches of trigeminal nerve takes over the sensory component whereas olfactory nerve takes over the function of special sensory part and atlas the branches of sympathetic fibres from first five thoracic segments of spinal cord, which synapses in the superior cervical ganglion and nerve fibres from pterygopalatine ganglion takes over the function of sympathetic and parasympathetic respectively carrying out the functions of secretomotor and vasomotor control. The postganglionic sympathetic fibres from the superior cervical ganglion runs along with blood vessel to nose and hence there is vasoconstriction and decreased secretion as sympathetic tone increases whereas the parasympathetic fibres arise from pterygopalatine ganglion for which fibres comes from lacrimal nucleus of midbrain via nervus intermedius. Parasympathetic fibres increases secretion from the nasal mucosa and causes swelling of nasal mucosa.

One of the prime function of nose is that it is an organ of smell but the most significant function is that of warming and humidification of inspired gas by means of its large surface area provided by concha and rich vascularity, ensuring that warm, clean and humidified air reaches the lungs. Nose filters gases and particles over 4 mm and clears it with the help of mucus whereas smaller particles, which are not filtered by nose reaches the lung and are cleared by macrophages. Humidification of air is to such an extent that it is 85 to 95 % saturated in nasopharynx itself . Hence bypassing these areas with an endotracheal tube ensures that cold and dry gases reach the lower respiratory tract resulting in diminished ciliary activity proceeding to microatelectasis.

Oral Cavity :

Oral cavity commences from the vestibule continuing on to upper and lower dentition, hard palate, tongue, floor of the mouth and opening of salivary glands.

Figure 2 - Oral cavity



Between the lips/cheek and gums/teeth lies the horseshoe shaped structure called vestibule which harbours the opening of parotid gland into it. The alveolar arches holding the teeth lies on the anterior part of oral cavity. Extending beyond the alveolar arches in the roof of nose lies the hard and soft palate. Hard palate, a bony plate is covered by two types of epithelium pseudostratified squamous epithelium above and stratified squamous epithelium below. In contrast to the hard palate soft palate is a muscular structure located posterior to the hard palate which on elevation seperates the oropharynx from nasopharynx. The floor of oral cavity harbours the tongue muscles, salivary gland and its ducts between the anterior pillar of fauces and posterior pilar of fauces lies the tonsillar fossa on which tonsils are located. Anterior pillar of fauces is the start of pharynx whereas the posterior part of tongue continues as epiglottis. Vallecula, a depression is present between these two areas. Nasopharynx harbours the adenoids (Pharygeal tonsils) whereas oral cavity along with oropharynx contains the lingual and palatine tonsils respectively forming a complete ring of lymphoid tissue known as the waldeyer’s ring. (Pharyngeal, palatine and lingualtonsil)

Pharynx :

Oropharynx, nasopharynx and laryngopharynx are the three functional and topographic divisons of pharynx. Internal nares and the nasal septums’s posterior border forms the anterior limit of pharynx. Anterior arch of atlas and axis together with the basilar part of occipital bone forms the posterior wall and roof respectively whereas the pharynotympanic tube, communicating with the middle ear cavity and soft palate forms the lateral wall and floor respectively. The soft palate on contraction rises and seals of the oropharynx from the nasopharynx.

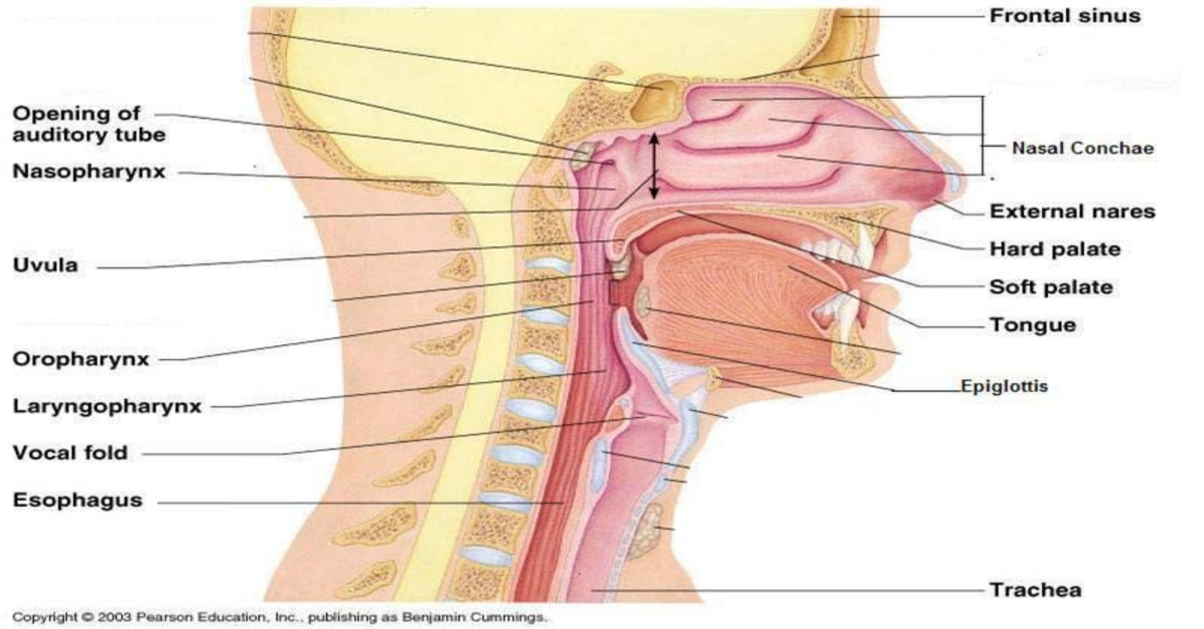
The oropharyngeal borders are formed superiorly, anteriorly, inferiorly and by softpalate, tonsillar pillars and dorsal part of tongue along with superior border of epiglottis respectively. Posterior border is formed by Superior and middle constrictors respectively.

Moving on to the laryngopharynx , its extension starts from the superior border of epiglottis and ends upto the lower border of cricoid cartilage . Middle constrictor, inferior constrictor, stylopharyngeus and palatopharyngeus occupies the posterior wall which extends from lower border of second cervical vertebra to upper border of sixth cervical vertebra and it is below here where larynopharynx ends giving way to esophagus.

As the laryngopharynx moves down, it opens anteriorly into the larynx, the boundaries of which are formed by the aryepiglottic fold above and cricoid cartilage along with posterior border of arytenoids below .Vocal cords of the laryngeal inlet protrudes into the laryngopharynx creating two hollows on both sides called as pyriform fossae. It is bounded by the thyroid cartilage along with thyrohyoid membrane laterally and aryepiglottic fold medially. Internal and inferior laryngeal nerve lies deep to the mucous membrane of pyriform recess.

Pharyngeal airway unlike nasal or laryngeal airway which is being supported by cartilaginous or rigid bony structure , is covered by just soft tissue and smooth muscle alone all along it wall and hence it is easily collapsible in certain conditions like sleep where the mandible is being pushed posterior , during flexion of neck , on external compression over hyoid bone and lastly during inspiration as a result of negative pressure being created in the lumen because of the diminished muscle tone especially when the patient is paralysed or sedated as normally during inspiration the collapse is prevented by the tone of muscles covering pharyngeal wall

Figure 3 - oropharynx and laryngopharynx

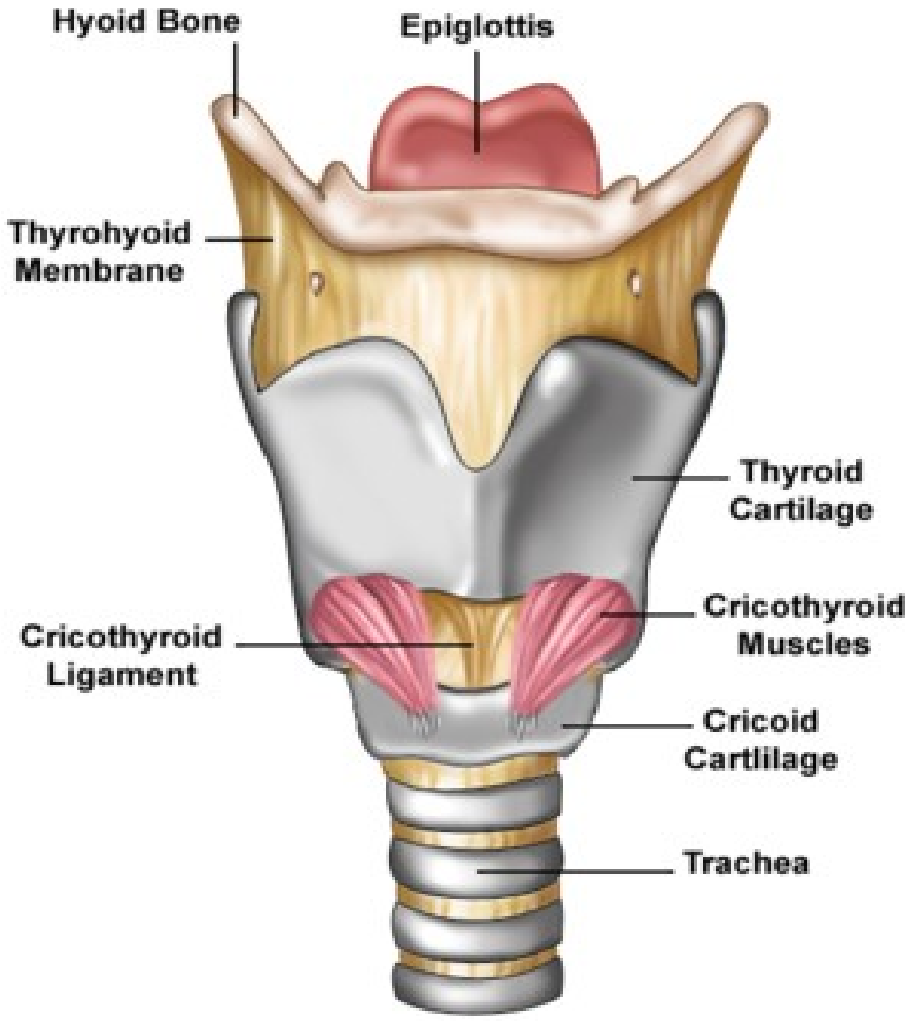


The pharyngeal muscles of the airway has other important functions in addition to the functions listed above, They have phasic inspiratory activity synchronous with diaphragmatic contraction. On inspiration, a suction force is created by the intercostals muscles and diaphragm which has to be balanced with the tone of muscles supporting the upper airway by dilating it. So in case of any obstruction in the upper airway it increases the resistance thereby exaggerating the suction force causing collapse of the airway. Once the airway gets collapsed it becomes difficult to reopen it, as adhesion of collapsed wall too becomes an added force to open it.

Larynx :

It is the organ of phonation and it corresponds to the vertebral level of C3-C6 protecting lower airway from aspirating contents of alimentary tract by means of glottic valve. Muscles, ligaments and framework of cartilages forms the structure. Starting from epiglottis, the cartilages forming larynx are arytenoid, cricoid, thyroid, cuneiform and corniculate. Epiglottis, a part of laryngeal cartilages is a fibrous cartilage overhanging onto the laryngeal inlet and extending to the pharyngeal surface of tongue forming glossoepiglottic fold. Valleculae are the depressions present on either side of the tongue on its posterior aspect.

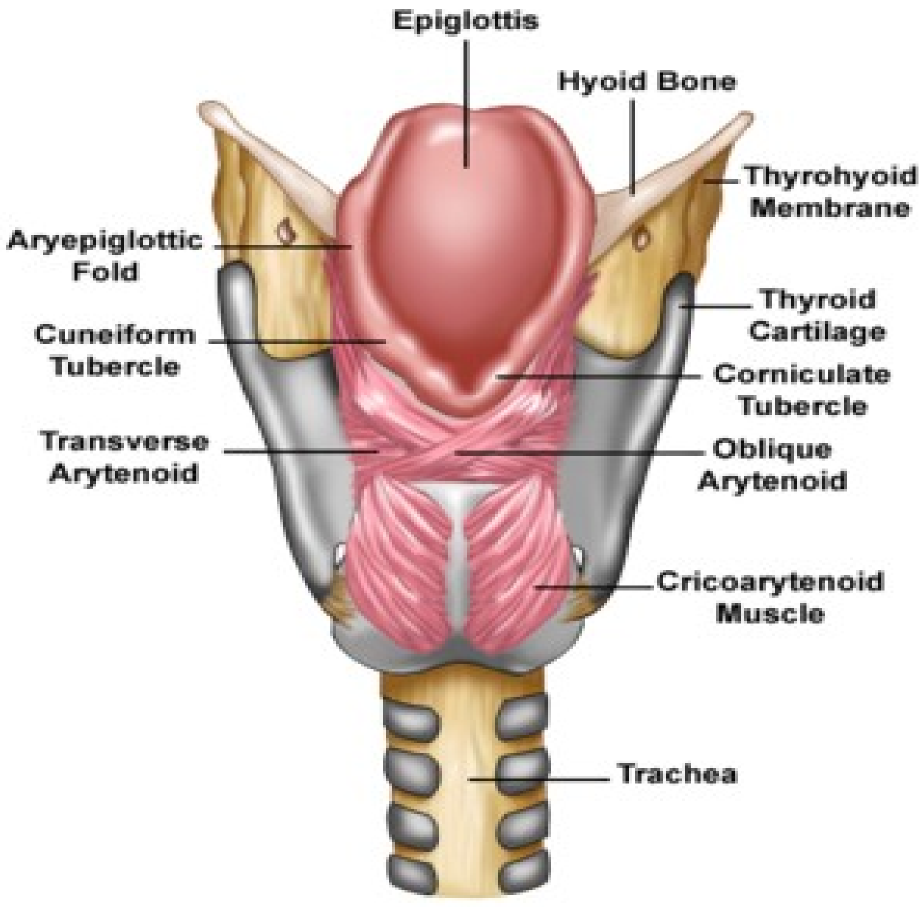
Figure 4 - Larynx front view



Coming to the laryngeal cavity it starts from epiglottis, the laryngeal inlet extending till cricoid cartilage. Aryepiglottic fold is a ligamentous structure extending from epiglottis to apex of arytenoid cartilages. Vestibular folds on the inner aspect of laryngeal cavity is termed as false cords. Laryngeal cavity and larynx thus has a very important function in which we the anaesthesiologists interfere. Hence extreme caution has to be taken to prevent any injury or edema which may provoke spasm or per se difficulty in ventilation.

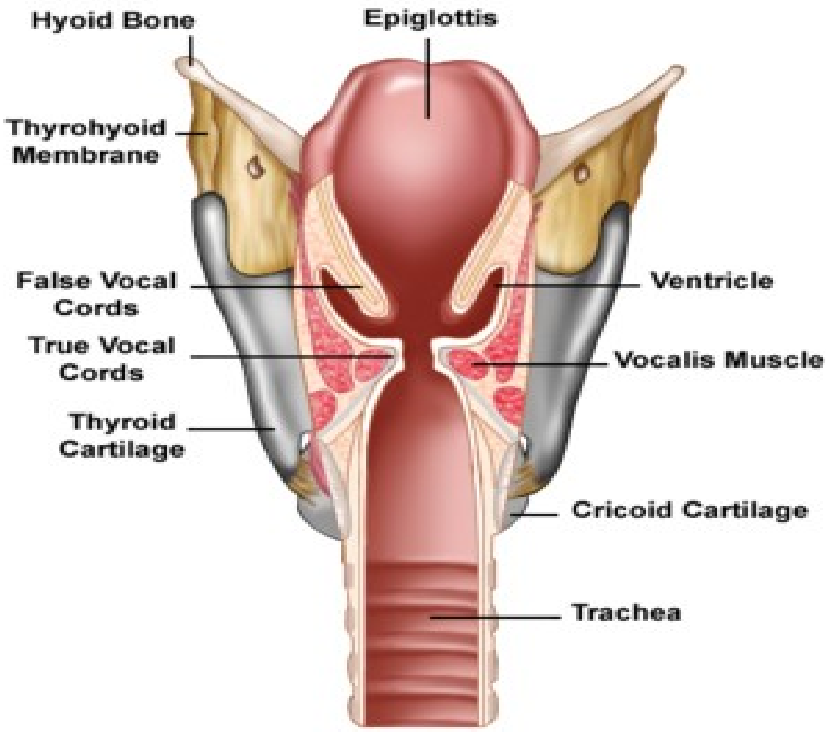
The precautions which has to be taken to prevent laryngeal trauma and edema in the preoperative period can be listed as selection of proper sized cuffed endotracheal tube which has to be neither too small to cause aspiration nor too big causing postoperative laryngitis and cough, secondly the volume of air we inject should be appropriate and finally prevent the patient from bucking due to inadequate plane of relaxation.

Figure 5 - Larynx Posterior view



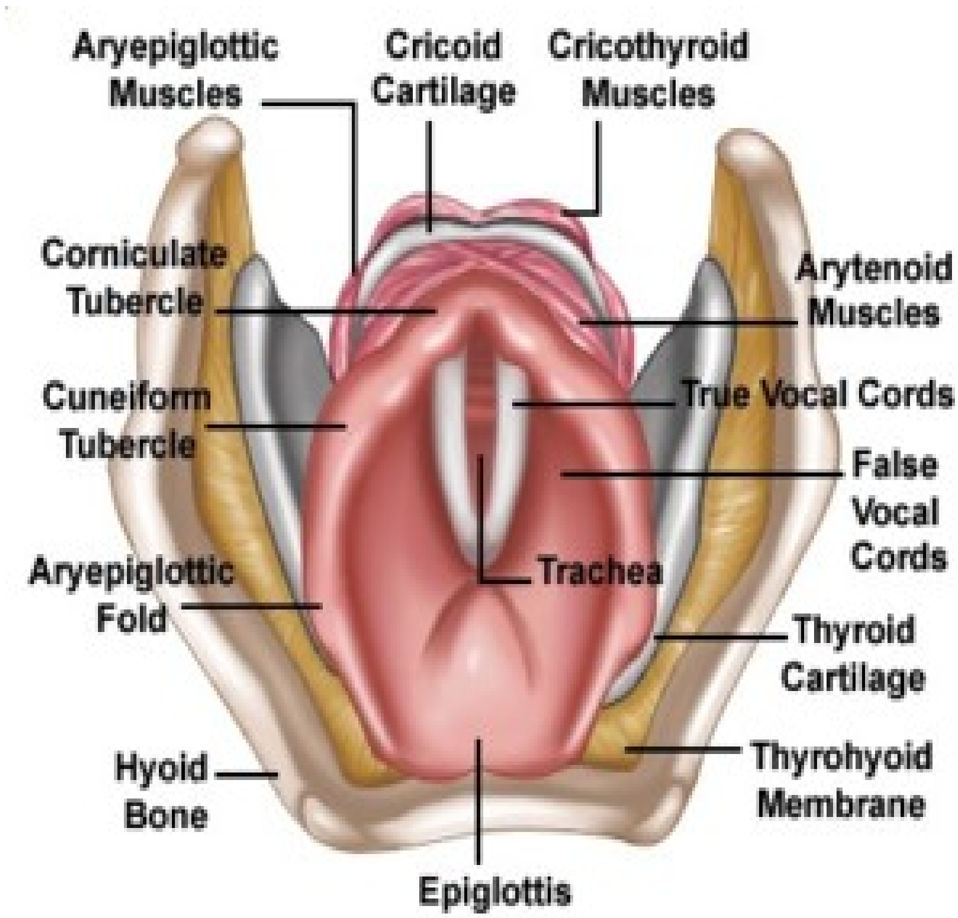
Extending from the anterolateral surface of each arytenoids to the angle of thyroid there are narrow bands of fibrous tissue on each side termed as false vocal cords. These false vocal cords are separated from true vocal cords by the laryngeal sinuses or ventricle. These true vocal cords are attached to the angle of thyroid cartilage and to arytenoids and are identified as pale white ligamentous structure. Between these two vocal cords is a triangle shaped structure termed glottis.

Figure 6 - showing larynx again



The muscular part of larynx it is classified into intrinsic and extrinsic muscles. Cricothyroid, Posterior, transverse, oblique and lateral cricoarytenoids along with thyroarytenoid comes under the category of intrinsic muscles whereas sternothyroid, omohyoid, sternohyoid, mylohyoid, stylohyoid, geniohyoid, hyoglossus, genioglossus, digastrics and inferior constrictor muscles comes under extrinsic category.

Figure 7 - Laryngoscopic view



The nerve supply to larynx comes from internal and external division of superior laryngeal nerve along with recurrent laryngeal nerve. Epiglottis, base of tongue, cricothyroid joint, thyroepiglottic joint and supraglottic mucosa is supplied by internal division of superior laryngeal nerve whereas sensory supply to anterior subglottic mucosa, thyroepiglottic joint and motor supply to cricothyroid comes from external division of superior laryngeal nerve. Sensory innervations to subglottic mucosa, muscle spindles and motor to thyroarytenoid, lateral cricoarytenoid, interarytenoid and posterior cricoarytenoid is supplied by recurrent laryngeal nerve.

Thus larynx is a very important structure maintaining the airway and protecting the airway from aspiration of gastric contents by functioning as a valve to occlude and protect the lower airway. Laryngeal inlet is the narrowest portion of entire airway system in the adults except for the anterior nasal passage. Cricoid cartilage is the only complete ring in our airway which has its own merits and demerits. The advantage is that it helps to prevent mendelson syndrome on application of sellick's maneuvour whereas the disadvantage is that in case of any injury causing mucosal edema, the edema has to occur inwards resulting in airway obstruction.

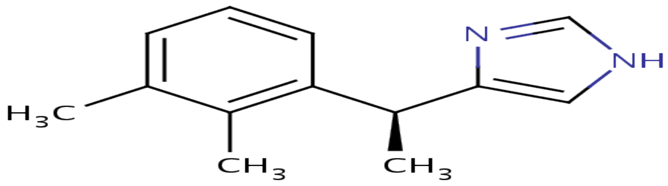
Hence the structures which play a major role in preventing the aspiration of foreign bodies and secretions are epiglottis, vocal cord and pharynx. Inspite of epiglottis covering the laryngeal inlet, it has not proved its worth in protecting airway soiling as it has paved way for the glottis to do the role . Hence the most important aspect in preventing the aspiration is glottis closure reflex. But prolonged, intense closure of this reflex (Glottic closure reflex) produces laryngospasm which is extremely dangerous for the patient as it prevents the air entry into the lower airways which inturn causes dyspnoea to the patient culminating in negative pressure pulmonary edema.

The airway related stimulus for laryngospasm can be from foreign body, secretions , anaesthetic agents and so on whereas laryngospasm may occur even from non airway related sources like stimulation of periosteum ,celiac plexus and also dilation of rectum and sometimes the reflex persist despite the removal of stimulus causing it . Hundred percent FIO_2 together with forward displacement of mandible and larson's manouveur on mask application helps to attenuate this reflex to some extent. In case of persisting reflex it requires the use of muscle relaxants and deepening of the anaesthesia plane.

.

PHARMACOLOGY :

DEXMEDETOMIDINE :



Dexmedetomidine is a selective $\propto_2$ – adrenoceptor agonist that received FDA approval in 1999. It is a short-acting drug when compared to clonidine. It is used in perioperative period for sedation , analgesia, premedication , general anaesthesia as an adjunct , neuraxial blockade and also for post- operative sedation and analgesia.

Physiology of $\propto_2$ -adrenoceptors :

Central nervous system , peripheral nervous system, effector organs like pancreas , vascular smooth muscles, liver, eye , kidney are the places where alpha 2 adrenoreceptors are located and is divided into three types which are

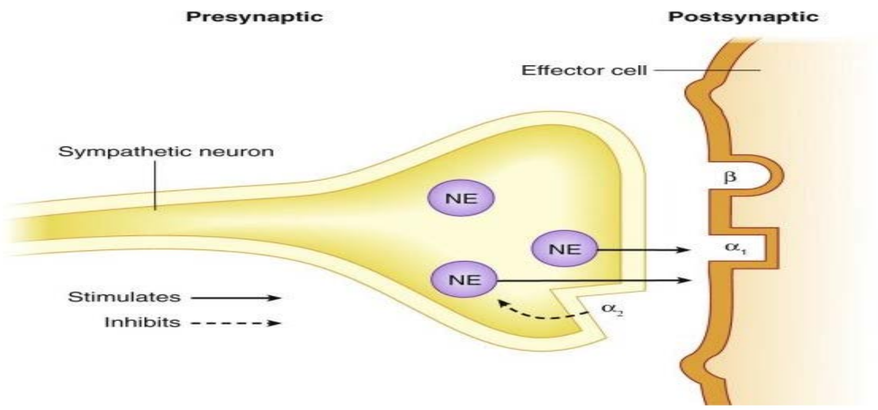
$\propto_2$A - predominant subtypes in CNS, and is responsible for sedation, analgesia and sympatholytic effect. Dexmedetomidine is 8 to 10 times more selective towards $\propto_2$ A receptor than Clonidine.

$\propto_2$ B – found mainly in the peripheral vasculature, and is responsible for the short term hypertensive response.

$\propto_2$C - found in the CNS, which is responsible for the anxiolytic effect & startle response.

.

Figure 8 - Dexmedetomidine receptors



All these subtypes produce cellular action by signalling through G-Protein, which couples to effector mechanisms. It differs depending on receptor sub-type and location. In case of $\propto_2$ A-Subtype , it acts on the calcium channels located in the locus ceruleus of the brainstem and vascular structures in an inhibitory fashion, on contrary the $\propto_2$ B subtype excites the same effector mechanism .

Mechanism of action of dexmedetomidine:

Dexmedetomidine has its own uniqueness and doesn't have same properties as the rest of sedatives. The site of action is on locus ceruleus, and acts by binding to $\propto_2$ A adrenoceptor and inhibits noradrenaline release which ultimately causes sedation and analgesia. Locus ceruleus has yet another component for dexmedetomidine to act which is nothing but descending medullospinal noradrenergic pathway which are meant to perform nociceptive neurotransmission and which when stimulated it blocks the pain signal propogation resulting in analgesia. Dexmedetomidine also acts on $\propto_2$ A adrenoceptor in the CNS reducing sympathetic activity which eventually causes hypotension and bradycardia and along with it dexmedetomidine also increases the cardiac vagal activity providing sense of wellbeing and anxiolysis .

At the level of spinal cord stimulation of $\propto_2$ –receptors in substantia gelatinosa it causes inhibition of the nociceptive neurons firing and inhibition of substance P release. It also has analgesic effect by inhibiting NE release at the nerve endings. It has been suggested that the main cause of analgesia is due to the action on spinal cord but it also has been postulated with evidence that both the supraspinal and spinal action is responsible for all the above said actions

$\propto_2$ B - receptors located on blood vessels mediates vasoconstriction whereas those located on sympathetic terminals inhibit NE release. In other areas these $\propto_2$ adrenoceptors cause contraction of vascular and other smooth muscles, decreases salivation, secretion and bowel motility, inhibits the release of renin, increases glomerularfiltration, decreases insulin release from pancreas, decreases intraocular pressure, decreases platelet aggregation and decreases shivering threshold by 2^{o}C.

Pharmacokinetics :

Absorption & Distribution :

At 0.2 to 0.7 µg/kg/hr dose of dexmedetomidine, it exhibits linear pharmacokinetics and it can be administered upto 24 hrs via infusion. The distribution phase is very rapid and hence 6 minutes is its distribution half life whereas elimination half life is more when compared with distribution half life which is around 2 hours.

Context sensitive half life, as it suggests varies depending on the duration of infusion. When the infusion is stopped after 10 minutes, the context sensitive half life is around 4 minutes whereas when it is stopped after 8 hours, the context sensitive half life increases to 250 minutes. The plasma concentration attains its peak level at 0.3 to 1.5ng/ml. 94 % of the administered is protein bound.

The distribution volume is 118 L. Because of extensive first pass metabolism, the oral bioavailability is very poor but in case of sublingual route, the bioavailability is very high and hence has a role in paediatric premedication and sedation.

Metabolism & Excretion :

Dexmedetomidine undergoes biotransformation through direct N-glucuronidation and cytochrome P-450(CYP 2A6) mediated aliphatic hydroxylation producing metabolites which are inactive and the synthesised metabolites are eliminated in faeces(4%) and urine(95%) .

Pharmacodynamics:

$\propto$-adrenoceptor agonists differs in their $\propto_2$ / $\propto_1$ selectivity. Dexmedetomidine is 8 times more potent than clonidine because of its high $\propto_2$ / $\propto_1$ selectivity ratio, which is 1620:1.

CVS:

Dexmedetomidine has no effects on the heart directly but instead has an indirect action by increasing the oxygen extraction and vascular resistance of coronary arteries as the dose increases. The ratio of Supply/demand is unaltered. On dexmedetomidine administration there is a short hypertensive phase caused by the $\propto$2B subtype and later on switches to hypotensive phase caused by $\propto$2A subtype, thus it elicits a biphasic blood pressure response. Persons who have high vagal tone develops bradycardia and sinus arrest.

RS:

Unlike other sedatives dexmedetomidine does not depress respiratory system even when we increase the dose of the drug. It maintains sedation without any respiratory drive depression. Hence it is used for weaning and extubation in trauma & surgical ICU patients in whom previous attempts at weaning have failed because of agitation associated with hyperdynamic cardio pulmonary response.

CNS:

Dexmedetomidine reduces cerebral blood flow and cerebral metabolic requirement of oxygen. It reduces levels of circulating and brain cetecholamines, thus balancing the ratio between cerebral oxygen supplies and demand. It reduces excitotoxicity, improves the perfusion in the ischemic penumbra, hence it has an excellent neuroprotective action. In case of subarachnoid hemorrhage dexmedetomidine decreases glutamate level which is a key agent responsible for cellular brain injury.

Endocrine and renal effects :

Dexmedetomidine activates peripheral presynaptic $\propto_2$–AR, reducing catecholamine release and sympathetic response to surgery. Dexmedetomidine being an imidazole agent when given in short doses does not inhibit steroidogenesis.

Adverse Effects:

Sideeffects reported are hypotension, hypertension, nausea, vomiting, dry mouth, bradycardia, atrial fibrillation, pyrexia, chills, pleural effusion, atelectasis, pulmonary edema, hyperglycemia, hypocalcaemia, acidosis, etc.

Clinical applications :

Premedication :

Dexmedetomidine is used as an adjuvant for premedication since this drug possess sedative, anxiolytic, analgesic, sympatholytic, and has stable hemodynamic profile. Premedication dose is 0.33 to 0.67 mg /kg IV given 15 minutes before surgery. Oxygen consumption is decreased in intraoperative period and in post operative period.

Intra operative use:

Dexmedetomidine attenuates the hemodynamic stress response which occurs during intubations and extubation by sympatholysis. Dexmedetomidine potentiates anesthesic effect of all the anesthesic agents, thus reducing their requirement.

Loco regional analgesia:

Highly lipophilic nature of dexmedetomidine facilitates rapid absorption into the cerebrospinal fluid. It binds to $\propto_2$ – AR of spinal cord for its analgesic action. Sensory and motor block produced by local anesthetics is prolonged. It is also used in intravenous regional anesthesia (IVRA), brachial plexus block. It is also given through intraarticular route in arthroscopic knee surgeries to improve the duration of postoperative analgesia.

Sedation in ICU:

Dexmedetomidine produce cooperative sedation. It does not interfere with the respiratory drive hence it facilitates early weaning from ventilator, thus reducing ICU stay costs. Many studies have recommended their use for longer than 24 hrs. Their other beneficial effects are minimal respiratory depression analgesic sparing effects, desirable cardio vascular effects, reduced delirium & agitation.

Procedural sedation :

Dexmedetomidine is used for short term procedural sedation like transesophageal echocardiography, colonoscopy, awake carotid endarterectomy, shockwave lithotripsy, elective awake fiberoptic intubation, pediatric MRI. The dose is 1 µg/kg with a maintainance dose of 0.2µg/kg/h.

Controlled hypotension :

Spinal fusion surgery for idiopathic scoliosis, septoplasty and tympanoplasty operations and maxillofacial surgeries have been done with dexmedetomidine induced hypotension.

Analgesia :

Dexmedetomidine as said above reduces the transmission of nociceptive signals in the spinal cord by activating $\propto 2$ receptors. It possesses significant opioid sparing effect.

Cardiac surgery:

Dexmedetomidine reduces the extent of myocardial ischemia during cardiac surgery. Its other uses are in the management of pulmonary hypertension in patients undergoing mitral valve replacement.

Neurosurgery :

Dexmedetomidine possess neuro protective effect. It also attenuates delirium and agitation, so that postoperative neurological evaluation will be easier. It has a role in functional neurosurgery like awake craniotomy surgeries and in Parkinson's disease.for implantation of deep brain stimulators.

Obesity:

In morbidly obese patients this drug does not cause respiratory depression in the dose of 0.7µg /kg intra operatively.

Obstetrics :

Dexmedetomidine is also used in obstetrics due to its maternal hemodynamic stabilizing property. It also produces anxiolysis and stimulation of uterine contractions. Since it is highly lipophilic it does not cross placenta and hence it cause less chance of fetal bradycardia.

Pediatrics :

Recently it is used in pediatric patients for sedation during non-invasive procedures in radiology like CT scan and MRI.

Other uses :

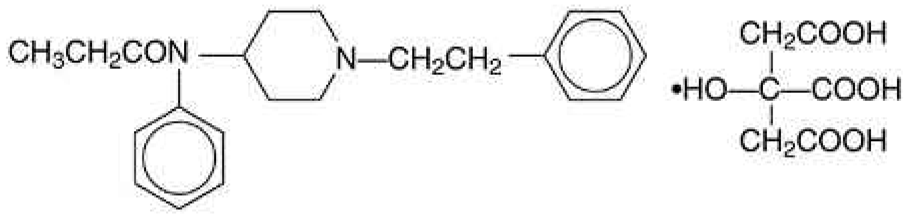
Used as an anti-shivering agent

Used as an alternative to clonidine unresponsive patient

Used in the treatment of withdrawal from benzodiazepines, opioids.

FENTANYL :

Fentanyl, an analgesic comes under the class of opioids, Its action on the opioid receptor is said to be agonistic .It is synthesised from phenyl piperidine and is identified chemically as N-(1-phenethyl-4-piperidyl) propioanilide citrate (1:1) . Being more potent than morphine, its molecular weight is 528.61. Fentanyl citrate's structure is



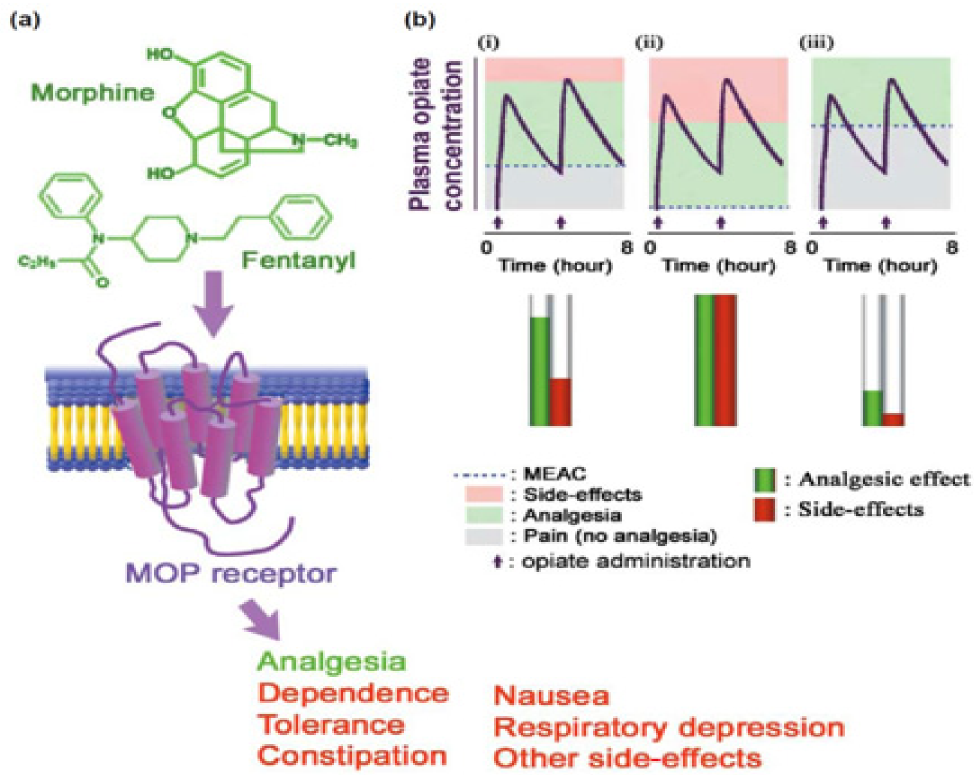
Fentanyl is available in 2 & 10 ml ampoules as nonpyrogenic, colourless, preservative free solution . 50 mcg of fentanyl is present in each ml at a pH of 4 to 7.5 adjusted with sodium hydroxide.

Mechanism of action:

As fenanyl is a mu receptor agonist, its important for us to know about the pharmacology of mu receptors. The receptors are broadly classified into μ_1 and μ_2 where the former plays the role of analgesia whereas the latter plays role on mediating physical dependence and bradycardia. Fentanyl binds to opioid receptor as an agonist and activates G protein system, and G proteins when activated inturn increases K^+ movement to extracellular space by altering membrane permeability and also decreases Ca^{++} movement into the cell, thereby hyperpolarising the membrane which ultimately inhibits neuronal function .

Fentanyl acts on the following sites like medulla, spinalcord , periaqueductal grey matter and spinal trigeminal nucleus . Spinoparabrachial and spinothalamic, the two ascending primary nociceptive pathways too are the targets for fentanyl where the former originates from superficial dorsal horn and feed areas of brain that are concerned with affect and the latter carries the nociceptive information to cortex areas concerned with both discrimination and affect .

Figure 9 showing G protein coupled receptors, site of action for fentanyl



Pharmacokinetics :

Fentanyl when absorbed to the blood stream rapidly distributes to heart, lungs, brain, kidneys and spleen because of its high lipophilicity followed which it slowly redistributes to muscle and fat. 80 to 85 % of the administered drug gets bound to plasma protein mainly with alpha-1-acid glycoprotein and some with albumin and other lipoproteins. Hence during acidosis the free fraction of drug increases. At steady state, the volume of distribution of the drug is about 4L/Kg

Cytochrome P450 3A4 carries out the metabolic function in organs like liver, intestinal mucosa. The metabolite is norfentanyl which has been found to be inactive in animal studies. More than 90 percent of administered drug is eliminated by biotransformation by means of hydroxylation and N-dealkylation into inactive metabolites. Rest of the drugs are excreted in faeces and urine. Faecel excretion is of not much significance to us. $t_{1/2}$ (Elimination halflife) of the drug after administration is about 7 hours whereas the total plasma clearance of fentanyl is found to be 0.5-7L/Kg/hr

Pharmacodynamics & uses :

Analgesia, anxiolysis, feeling of relaxation, euphoria, cough suppression, constipation, respiratory depression and miosis are all the pharmacological effects of opioid agonist. There is no ceiling effect for opioid agonist unlike agonist/antagonist and non opioid analgesics which means when the dose of opioid agonist increases, we can see a similar increase in analgesic effect too and hence there is no maximum limit for its action but instead the maximum dose is limited to prevent the side effect of drugs especially respiratory depression.

Analgesia:

As said above there is no ceiling effect and so the level of analgesia correlate with the level of concentration of fentanyl in the blood stream. Side effects start to develop beyond a certain dose but on the other hand tolerance starts to develop and it increases the threshold dose at which toxicity develop. Thus the tolerance rate varies among individuals.

Central nervous system:

The mechanism by which analgesia occurs is not knowm. About the fentanyl, the thing known to us is that it acts on mu receptor but to our surprise many other receptors for endogenous compounds with opioid like activity has been found on which fentanyl acts. Hence it needs a detailed study before documenting whereas some of the other side effects and effects like respiratory depression, cough suppression are proven to occur because of the direct action on brain stem respiratory centers and cough centres in medulla respectively. The respiratory depression is due to non-responsiveness to both increased carbondioxide concentration and electrical stimulation. Fentanyl is also known to cause miosis or commonly referred to as pinpoint pupil. It occurs in case of opioid overdose but not in opioid overdose alone. Fentanyl or generally opioids are notorious for their nausea and vomiting which probably might be due to direct action on vomiting centres in medulla.

Gastrointestinal system *:*

Increase in the tone of smooth muscles in antrum of the stomach and duodenum is being noted and is also associated with reduction in motility of small intestine along with propulsive contraction as a result of which there is quite a delay in the digestion of food particles. Coming to the large intestine, propulsion of peristaltic wave is decreased here too and the smooth muscle tone too are affected.

There is also a decrease in the secretion of digestive juices like pancreatic, biliary and gastric secretions. Smooth muscle spasm of sphincter of oddi and increase in serum amylase are the other findings

Cardiovascular system :

Like other opioids fentanyl causes allergic reactions by means of histamine release along with peripheral vasodilation which are being manifested as red eyes, flushing, sweating, pruritus, orthostatic hypotension.

Endocrine system:

Opioids have their role on endocrine organs by inhibiting, stimulating or both inhibiting and stimulating the secretion of various hormones among the endocrine organs. ACTH and cortisol secretions are inhibited by opioids whereas secretion of insulin and glucagon are stimulated. The hormone which is both inhibited and stimulated is thyroid stimulating hormone(TSH)

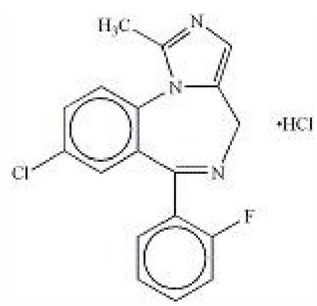
Respiratory system*:*

Dose dependant respiration depression is very common among patients receiving fentanyl because of its action on mu receptors however it is very less common in those patients who are receiving chronic opioid therapy because they have developed tolerance to those drug effects .The respiratory physiology mentioned here is because of the suppression of opioid receptor present in the brainsem respiratory centre to any of the normal stimulus like increased CO_2 concentration or any electrical stimulation .

Fentanyl, especially when administered swiftly causes classic muscle rigidity and chestwall tightness interfering with the normal respiration, causing dyspnoea and absent or decreased chestwall movements .Fentanyl also has antitussive action causing cough suppression by its direct action on cough centres located in medulla.

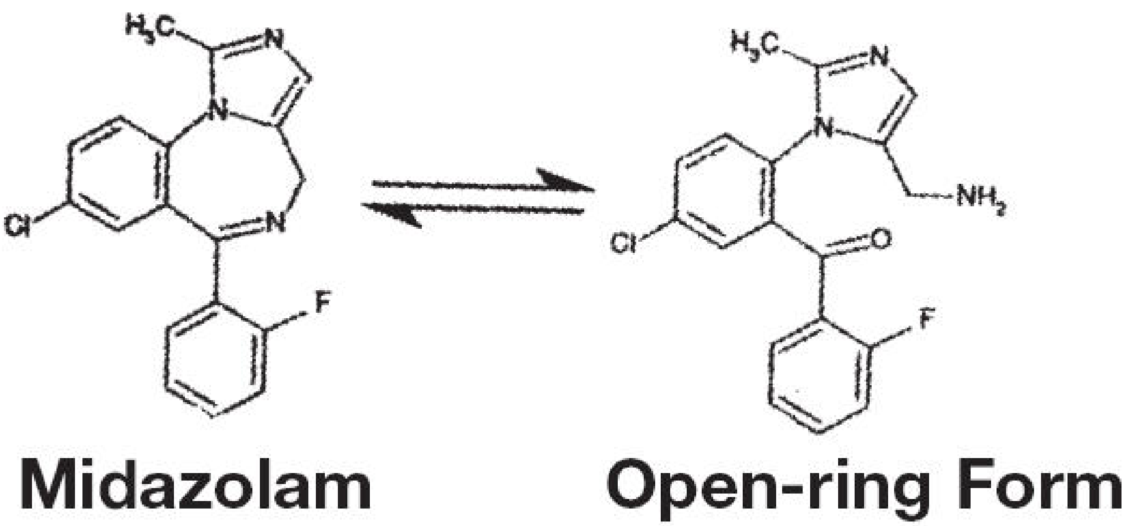
MIDAZOLAM :

Midazolam hydrochloride is yellow to white crystalline compound used in anaesthesia as a sedative hypnotic to relieve the anxiety of the patient. Being insoluble in water, it can be solubilised in aqueous solution by means of conversion to its hydrochloride salt which occurs when exposed to acidic environment. The chemical formula for midazolam is 8-chloro-6-(2-fluorophenyl)-1-methyl-4 *H* -imidazo[1,5-a][1,4] benzodiazepine hydrochloride .The molecular formula for midazolam hydrochloride is $C_{18}H_{13}ClFN_3 \cdot HCl$, whereas its molecular weight is 362.25. The structure of midazolam hydrochloride is

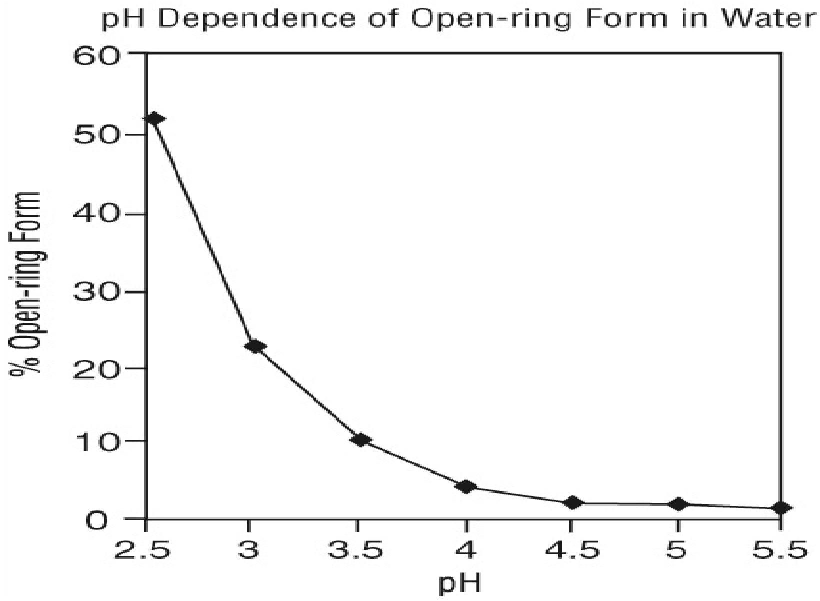


Midazolam is available in vial form mixed with anhydrous sodium citrate, artificial bitterness modifier, disodium edentate, mixed fruit flavour, glycerin, sodium benzoate, water and sorbitol. The solution is prepared in the pH between 2.8 to 3.6 along with hydrochloric acid. Each ml of the solutions contains either 2 or 1 mg of midazolam hydrochloride mixed with above said components. Midazolam is soluble in the syrup only under acidic conditions. Midazolam plays a dual role by being present in two forms in an equilibrium mixture , the open ring(Soluble in water) and closed ring forms(Waterinsoluble and lipid soluble) , where the former occur as a result of acid catalyzed ring opening of diazepine ring at the 4,5 double bond and the later just exist perse. The percentage of open ring and closed ring form differs depending on the pH of the solution which means when present in vial the percentage of open ring (water soluble) form is high whereas when the solution on administration at the physiologic pH(6 to 8) revert back to closed ring (water insoluble and lipid soluble) form .

Figure 10 showing the open ring form



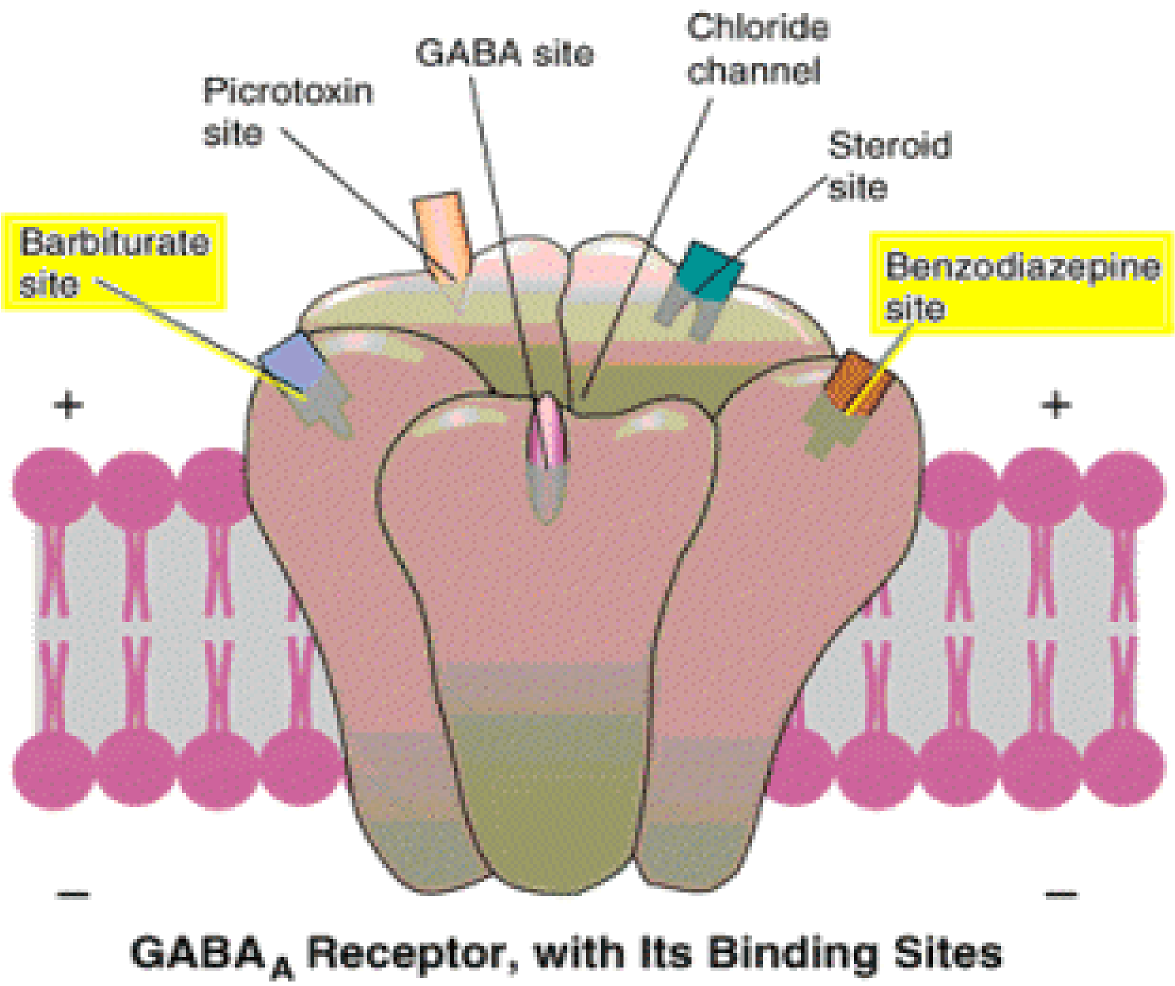
The percentage of open-ring form as a function of pH in an aqueous solution can be plotted on a graph. The percentage of midazolam occurring in open ring form in aqueous solution, sensitive to pH changes only in the pH between 2.8 to 3.6. At a pH above 5, the existence of open ring form is nil or almost less than 1 percentage.



Mechanism of action :

Similar to other benzodiazepines, the site of action is on the GABA-A receptors which is part of benzodiazepine-GABA receptor-Chloride ionophore complex. Membrane hyperpolarisation occurs as a result of opening of chloride channels which inhibits neuronal conduction. Also these group of drugs prevents the GABA reuptake thereby increasing GABA at the receptor level. This increase in GABA facilitates GABA mimetic action. Finally the means of amnesia occurance is not yet found accurately and it doesn’t correlate with the drowsiness that midazolam produces.

Figure 11 showing the GABA A receptor, site of action for benzodiazepines



Pharmacokinetics :

Distribution:

Midazolam has high plasma protein binding capacity especially in paediatric patient more than one year and adult patient, almost 97% of the administered drug gets bound to the plasma protein, mostly albumin. α-hydroxymidazolam, a metabolite of midazolam binds to plasma protein by a percentage of 89% . The mean volume of administration at steady state is from 1.24 to 2.02 L/Kg in paediatric patients (<16 years to 6 months).

Metabolism & Elimination :

Metabolism occurs at liver and intestine by human cytochrome P450 IIIA4 (CYP3A4) producing a pharmacologically active metabolite, α-hydroxymidazolam which is almost equipotent as midazolam perse. This metabolite then undergoes glucuronidation forming α- hydroxymidazolam glucuronide. The glucuronidated metabolite, being water soluble is excreted in urine. It is being estimated that after intravenous or oral administration, almost 70 percent of the drug is excreted in urine. The other two metabolites which are of not much significance are 4-hydroxy midazolam (3% of administered drug) and 1,4-dihydroxy midazolam (Less than 1%). Both these metabolites are excreted in urine as well after conjugation with glucuronide. Thus no parent drug which hasn't been metabolised or metabolite which hasn't undergone glucuronidation or sulfatase deconjugation are excreted in urine perse.

Uses :

- Preoperative sedation and anxiolysis as premedicant
- Procedural sedation for diagnostic and therapeutic procedures
- General anaesthesia induction

- As maintanence drug for minor surgical procedures along with other anaesthetics
- It is used as sedation in patient with ETT tube insitu on mechanical ventilation in critical care setting and postoperative ward for patients who doesn’t tolerate the artificial respiration with ventilator
- It is widely used for treatment as first line of management in epileptic seizures.and in case of refractory status epilepticus. where midazolam causes burst suppression.

FIBEROPTIC BRONCHOSCOPE :

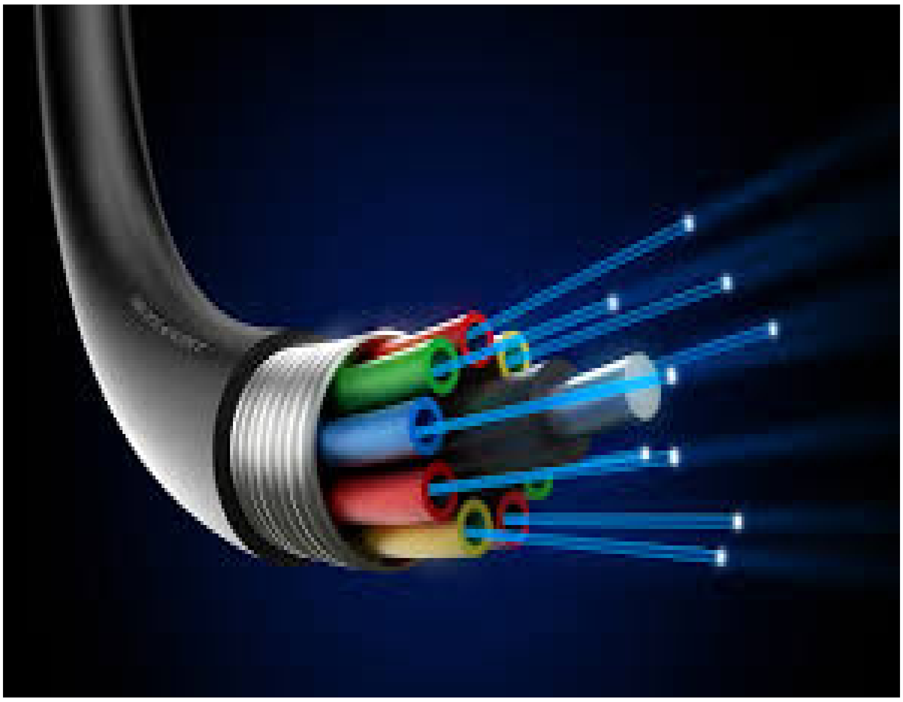
Airway problems plays a major part in terms of morbidity and mortality due to anaesthesia. The available data suggests that failure to intubate and failure to ventilate constitutes one third of all anaesthetic deaths, for which many airway devices were introduced in the recent times .Fiberoptic bronchoscope is one among them. The flexible fiberoptic is useful to the extent that it can manage almost any difficult airway in the hands of a welltrained practitioner. The use of fiberoptic instruments to help in airway management is a relatively a recent event.

Fiberoptic instrument was first used by Dr.Murphy in 1967 for a nasal intubation. He performed the procedure in a patient with advanced still's disease under General anaesthesia with a choledocoscope

Fiberoptic scope basics :

Light travels in different velocity in different substance .Velocity of light through the substance with that through vacumm indicates the refractive index of the substance , based on which the velocity of light differs for each substance . Hence there is alteration in the direction of light beam as it travels from one substance to the other .This difference in velocities has the effect of altering the direction of a light beam as it passes from one medium to another. Light passes straight through when it hits a glass-air interface at 90 degree, other than that degree light seems to alter its direction. Hence the angle of incidence plays a major part, which tells why a light bends better when its angle of incidence is increased from the perpendicular as it travels from glass to air .

Figure 12 : Showing fiberoptic scope cut section



Finally at a point there will be total internal reflection of light where the light is reflected back inside the glass , the angle of incidence at which this occurs is said to be the critical angle . So its possible for a light to travel from one end of a glass rod to the other

Design :

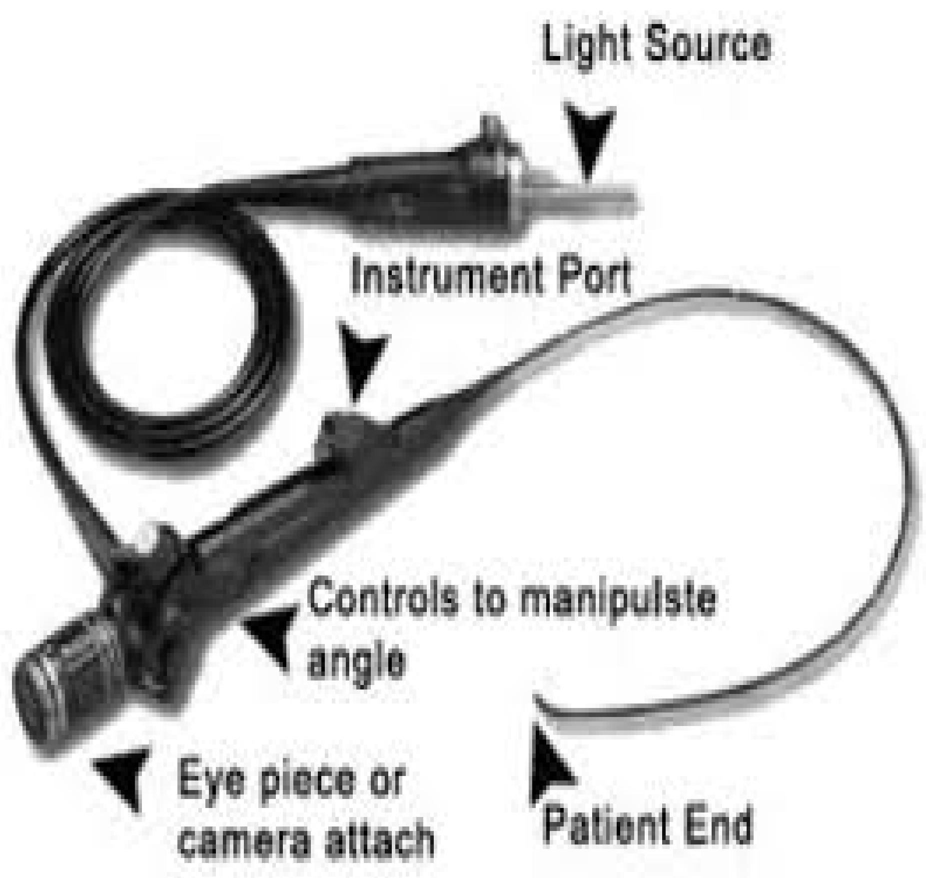
The fiberoptic scope, being flexible can transmit image from the distal tip to proximal end. The tip of fiberoptic scope is designed in a fashion that its motion can be controlled in any direction which provides an opportunity for the operator to direct the scope in any direction and hence

- Controllability
- Flexibility
- Image transmission

are said to be the hallmark features of fibreoptic scope .

The proximal and distal end of the scope are tightly fastened together by organised, coherent bundle of flexible fibres which are optically insulated. Its these features which helps in image transmission. Also each fibres are coated with a transparent substance of lower refractive index called cladding which helps in light transmission and optical insulation of fibers.

Figure 13 showing the parts of fiberoptic scope



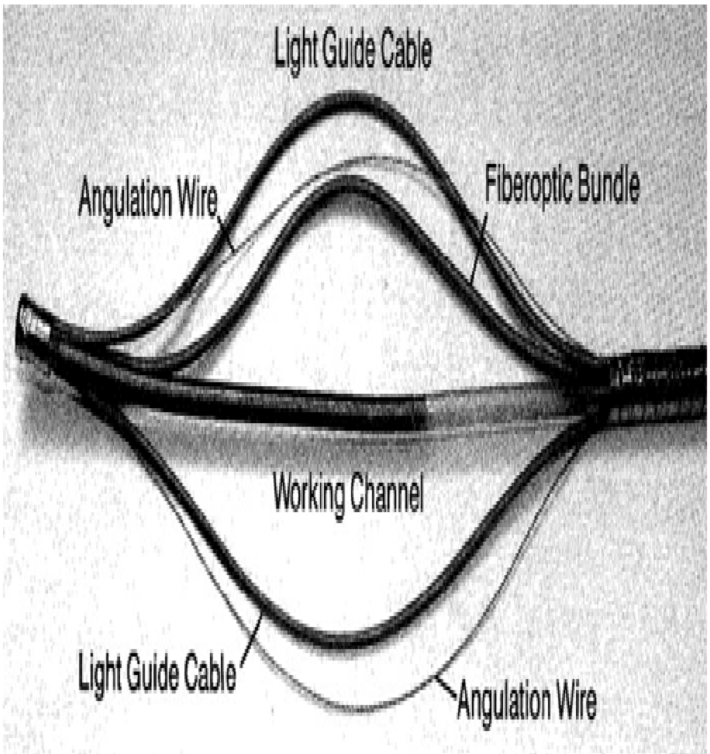
Manipulation and handling the scope :

Nasal or oral route can be chosen for intubation in fiberoptic scope depending on the user's ease. Maneuvers to handle the scope are listed below

- Moving in and out controls the depth
- Rotation of the scope controls the anterior/posterior motion
- Tip manipulation for side movement

The insertion cord should be free of torque in order to maintain the control of tip of fibreoptic scope .The control unit should be held in one hand and the insertion cord to be stretched in a taut manner for a better view . Insertion cord if twisted results in loss of coordinated motion between control lever in the handle and the tip of fiberoptic scope.

Figure 14 showing parts of fiberoptic cord



MATERIALS AND METHODS :

- Study Design and setting
- Sample size calculation
- Study population
- Randomization and Allocation
- Masking
- Objective
- Anaesthesia protocol
- Premedication
- Pre-induction period
- Induction and maintenance
- Protocol
- Results
- Statistical analysis

METHODS :

Study design:

This was a single centre, prospective, randomized, parallel group, double blinded study. The study was conducted in the department of Anaesthesiology, Tirunelveli Medical College, Tirunelveli from the period March 2014 to December 2014.

After institutional ethical committee approval and written informed consent, 40 adult patients of both sexes, within the age group of 25 to 50 years belonging to ASA 1 & 2 physical health status undergoing thyroid surgery were recruited. They were randomized using computer generated random numbers and allocated into two groups, Group D and Group FM as follows

Group D: Received 1 mcg/kg of Dexmedetomidine administered over 10 mins followed by infusion dose of 0.7 mcg/kg/hr.

Group FM: 2 mcg/kg of Fentanyl with 40 mcg/kg of midazolam over 10 mins followed by an infusion of normal saline.

Sample size calculation:

Sample size was chosen to be 40 and was calculated from

1. Correlation coefficient
2. Alpha error which we kept as 20 %
3. Power of the study which in turn was calculated from beta error which was assumed to be 5 % (Power of the study = 1 – beta error)

Study population :

Inclusion criteria

- Age : > 25years < 50 yrs.
- ASA (American Society of Anaesthesiologists) 1& 2 patients
- BMI: 20 – 30
- Patients undergoing thyroid surgery with euthyroid status

Exclusion criteria

- Patient refusal
- Emergency surgeries
- Difficult airway
- Coagulopathies or any bleeding disorder
- Fracture base of skull
- Ischemic heart disease/Valvular heart disease/arrrythmia or any conduction abnormalities
- Known hypersensitivity to any of the study drugs
- Raised intracranial pressure
- Uncontrolled seizure disorder

- Known psychiatric illness, receiving treatment in the past two weeks, where either dexmedetomidine or benzodiazepine administration is contra-indicated
- Heart rate <50bpm & Systolic blood pressure <90 mmHg
- Patients with respiratory system disorders , renal disorders & liver disorder

MASKING:

The study was carried out in a double blinded fashion. The patients on whom study was conducted were blinded and they did not know what drug they were administered. The drugs, both for bolus administration and infusion was prepared by an anaesthesiologist who was not involved in the study and hence the investigator who conducted the study was also blinded.

Both the group received 50 ml of bolus dose administered over 10 minutes at a rate of 5 ml/min, with group D receiving dose of 1 mcg/kg dexmedetomidine and group FM 2 mcg/kg of fentanyl and 40 mcg/kg of midazolam .Patients in both the group were followed with infusion of 100 ml plain normal saline in case of Group FM and 100 ml of normal saline mixed with dexmedetomidine at the rate of 0.7 mcg/kg/hr for dexmedetomidine .

PROCEDURE :

After pre-anaesthetic evaluation, the more patent nostril (right or left sided) was identified.Inj. Glycopyrrolate 0.2 mg intramuscularly was given as premedicant 45 mins before the procedure. Nasal and oral part of airway was anaesthetised by means of nasal packing and oral gargling with 4 % Lignocaine, 15 mins before the start of procedure. Nasal packing was done with 4 cotton pledgets soaked in 4 ml of 4 % Lignocaine mixed with adrenaline (1:200000 dilution) two each for both the nostrils. Oral gargling was performed with 2 ml of 4 % lignocaine. iv infusion of ringer lactate started in the nondominant arm after securing intravenous access . ECG, NIBP, SpO_2 monitors were connected to the patient, and $ETCO_2$ after intubation. Anaesthetist who is experienced and well trained with fibreoptic scope and a skilled the are technician was called for and made ready in case if any help is needed. Fiberoptic scope, light source and appropriate sized endotracheal tubes were kept ready. All the components of boyle's checklist were verified and ensured that nothing is missed before administering the drug.

Baseline heart rate , BP , SpO2 were recorded and noted down after which the bolus drug , Dexmedetomidine or Fentanyl & midazolam based on the group was administered over 10 minutes followed by infusion . Sedation level was graded as 1, 2, 3 & 4. Intubation commenced when sedation level reached grade 2. Local anaesthetic was sprayed as the fibreoptic scope went past the oropharynx, after the glottis was visualized. Time taken for intubation, ease of intubation and comfort scores of the patient were noted down. Hemodynamic variables like heart rate, Spo2, systolic BP, Diastolic BP, Mean arterial pressure & respiratory rate were noted at the end of intubation, 6 th, 8 th & 10 th minute after the procedure. After which patients were observed for the following secondary outcomes

- Hemodynamic variables
- Sedation scale based on Ramsay sedation scoring system
- Ease of intubation based on intubation scoring system
- Comfort scores modified from Ambu et al
- Intubation time
- Airway trauma

SEDATION:

Assessed as six point scale (Ramsay sedation scale)

GRADE	DESCRIPTION
1	Anxious and agitated or restless, or both
2	Co-operative, oriented, and tranquil
3	Responds to commands only
4	Exhibits brisk response to light glabellar tap or loud auditory stimulus
5	Exhibits a sluggish response to light glabellar tap or loud auditory stimulus
6	Exhibits no response

INTUBATION SCORES:

Assessed by vocal cord movement

GRADE	VOCAL CORD MOVEMENT
0	Open
1	Moving
2	Closing
3	Closed

COMFORT SCALES:

	ALERTNESS	CALMNESS	RESPIRATORY RESPONSE	CRYING	PHYSICAL MOVEMENT	MUSCLE TONE	FACIAL TENSION
1	Deeply asleep	Calm	No coughing and no spontaneous respiration	Quiet breathing, no crying	No movement	Muscles totally relaxed, no muscle tone	Facial muscle totally relaxed
2	Lightly asleep	Slightly anxious	Spontaneous respiration	Sobbing or gasping	Frequent slight movements	Reduced muscle tone	Facial muscle tone normal, no facial muscle tension evident
3	Drowsy	Anxious	Occasional cough	Moaning	Vigorous movement limited to the Extremities	Normal muscle tone	Tension evident in some facial muscles
4	Fully awake & alert	Very anxious	Coughing regularly	Crying	Vigorous movements including torso and head	Increased muscle tone and flexing of fingers and toes	Tension evident throughout facial muscles
5	Hyper-alert	Panicky	Frequent coughing or choking	Screaming	Occasional slight movement	Extreme muscle rigidity	Facial muscles contorted and grimacing

The total comfort score for each patient was calculated by adding the scores of the 7 comfort categories at each time point(Modified from ambu et al). Patients score is calculated from a total Score of 35.

The information collected from all cases were recorded in a master sheet. Mean and Standard Deviation, Median and Percentiles were provided for all the continuous variables and frequencies and percentages for categorical variables. The outcome variables were compared between pre and post measurements using Paired t-test, if they are normally distributed. For variables which were not normally distributed Wilcoxon Signed Rank Test was used to compare the medians between pre post measurements.

Data was analyzed using Statistical package for social science (SPSS) software and Sigma Stat 3.5 version (2012). Using this software, frequencies, percentage, mean, standard deviation and 'p' value were calculated through

- Student 't' test
- One way ANOVA
- Chi square test

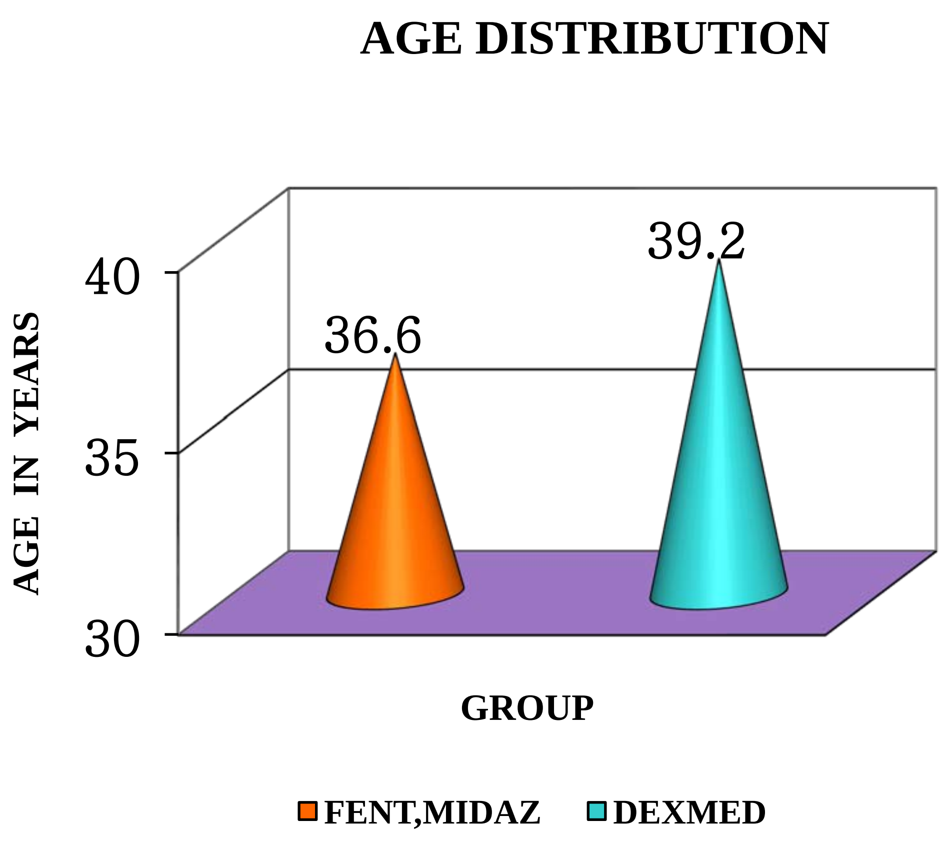
P value of < 0.05 was taken as significant.

RESULTS

Table 1 : Showing the mean , standard deviation , P & T value regarding to age

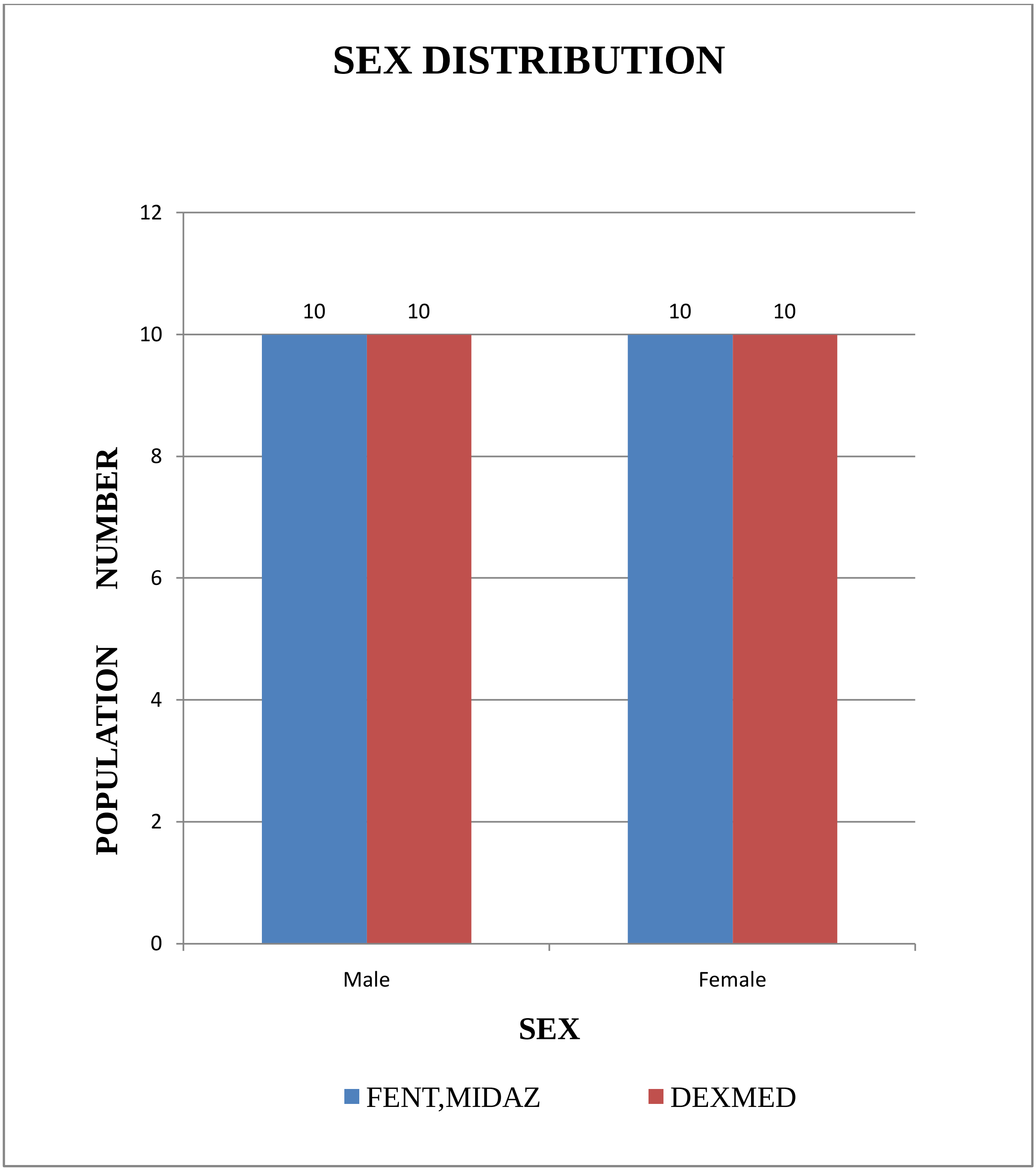
Group	Mean	SD	P value	T value
Fent&Midaz	36.6	13.03	0.513	0.66
Dexmed	39.2	11.85		

Fig 15 : Comparison of age distribution between the two groups distribution



The age incidence of our study belonged to patients of all ages in the range of 25 to 50 years as shown in table 1 with mean falling in the mid range

Figure 16 : Comparison of sex distribution between the two groups



The male and female populations of our study was distributed equally with ten in each group and in each category .

Table 2 – Comparison of weight distribution between two groups

Group	Mean	SD	P value	T value
Fent&Midaz	62.45	13.14	0.783	0.278
Dexmed	63.75	16.28		

Figure 17 : Comparison of weight distribution among the two groups

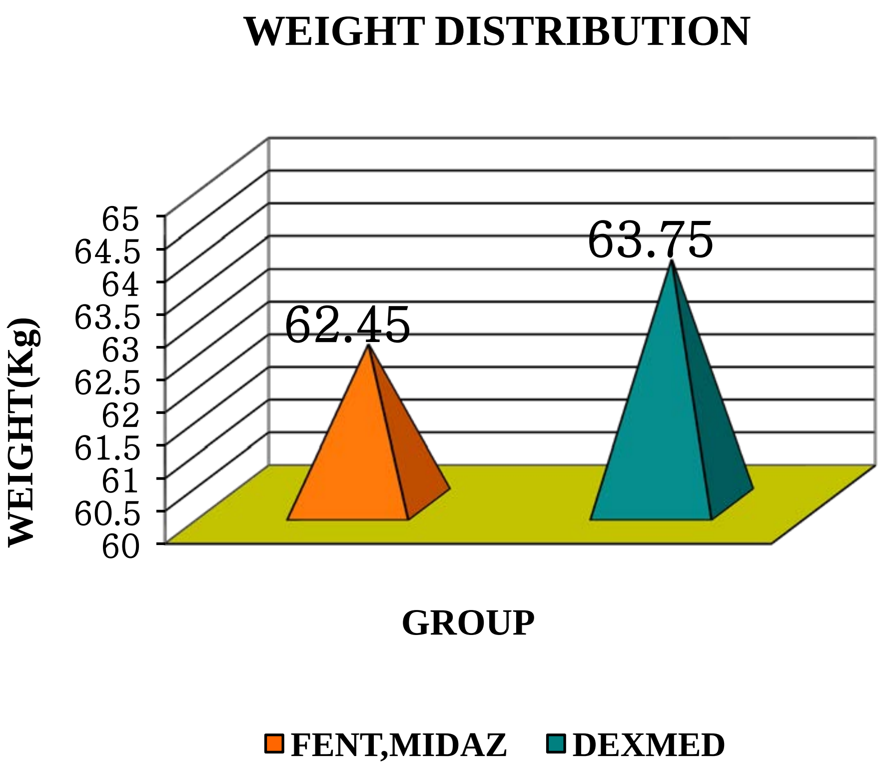


Table 3 – Comparison of BMI distribution between two groups

Group	Mean	SD	P value	T value
Fent,Midaz	22.46	4.38	0.587	0.548
Dexmed	23.28	5.05		

Figure 18 : Comparison of mean distribution of BMI between two groups

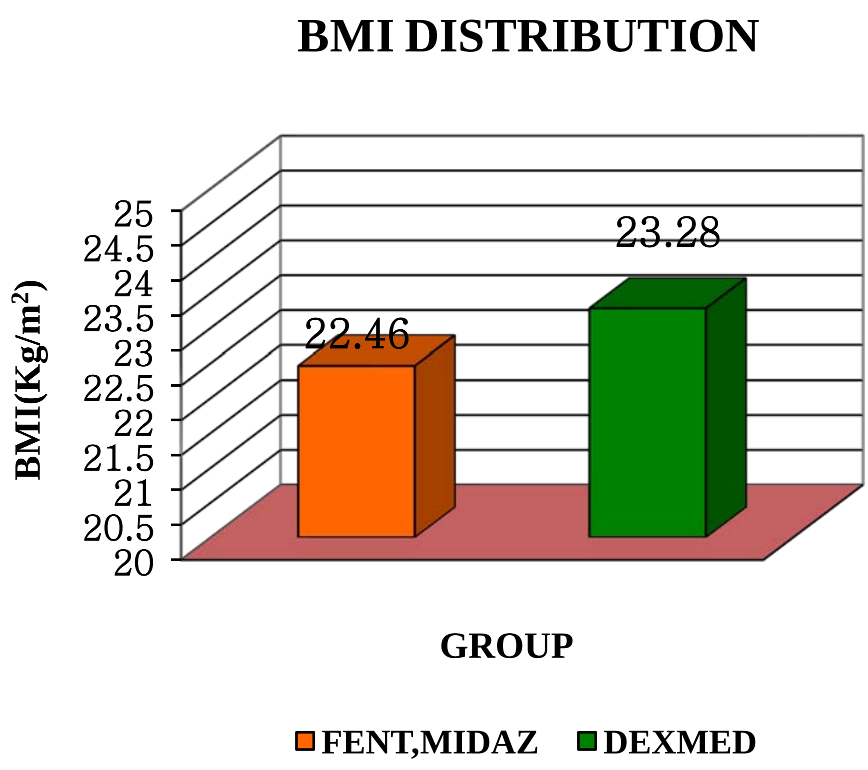
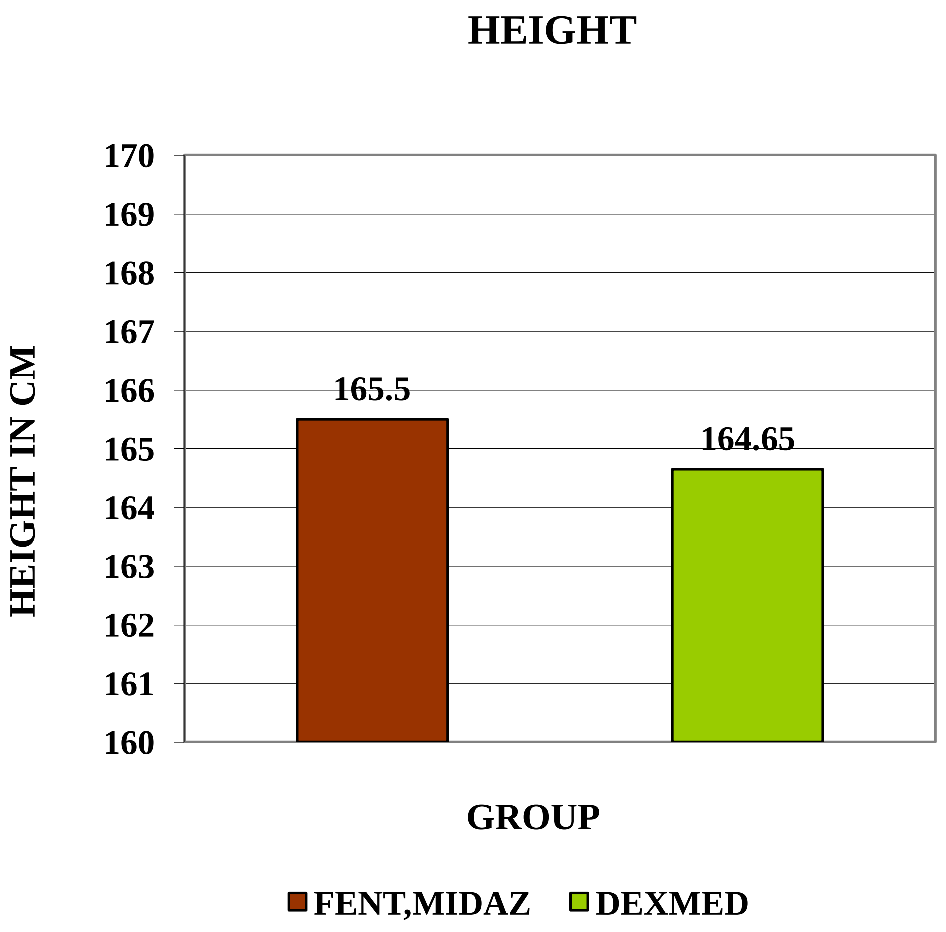


Table - 4 Comparison of height distribution between two groups

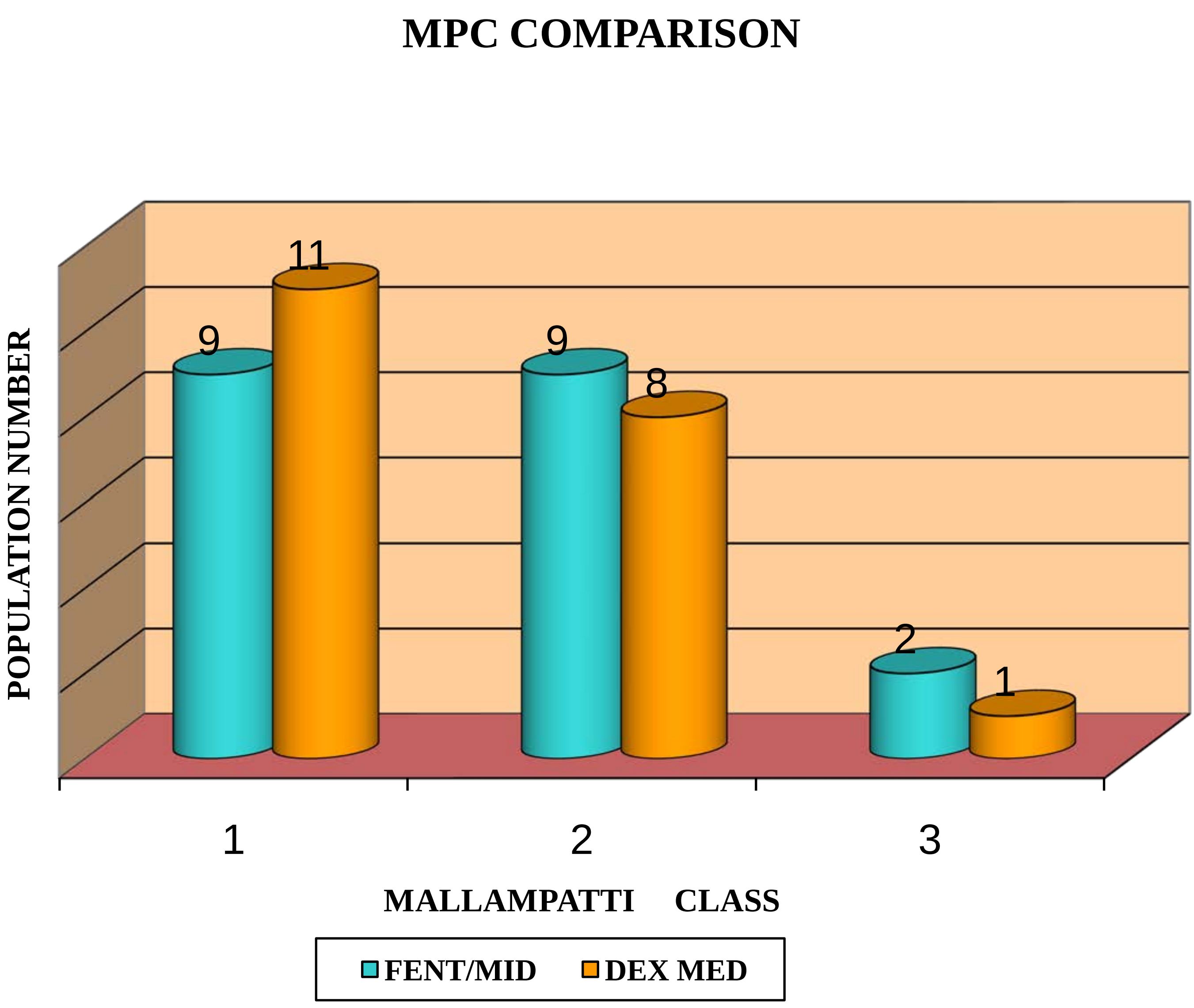
Group	Mean	SD	P value	T value
Fent,Midaz	165.5	5.79	0.672	0.426
Dexmed	164.65	6.77		
Total				

Figure 19 : Comparing the mean distribution of height among two groups



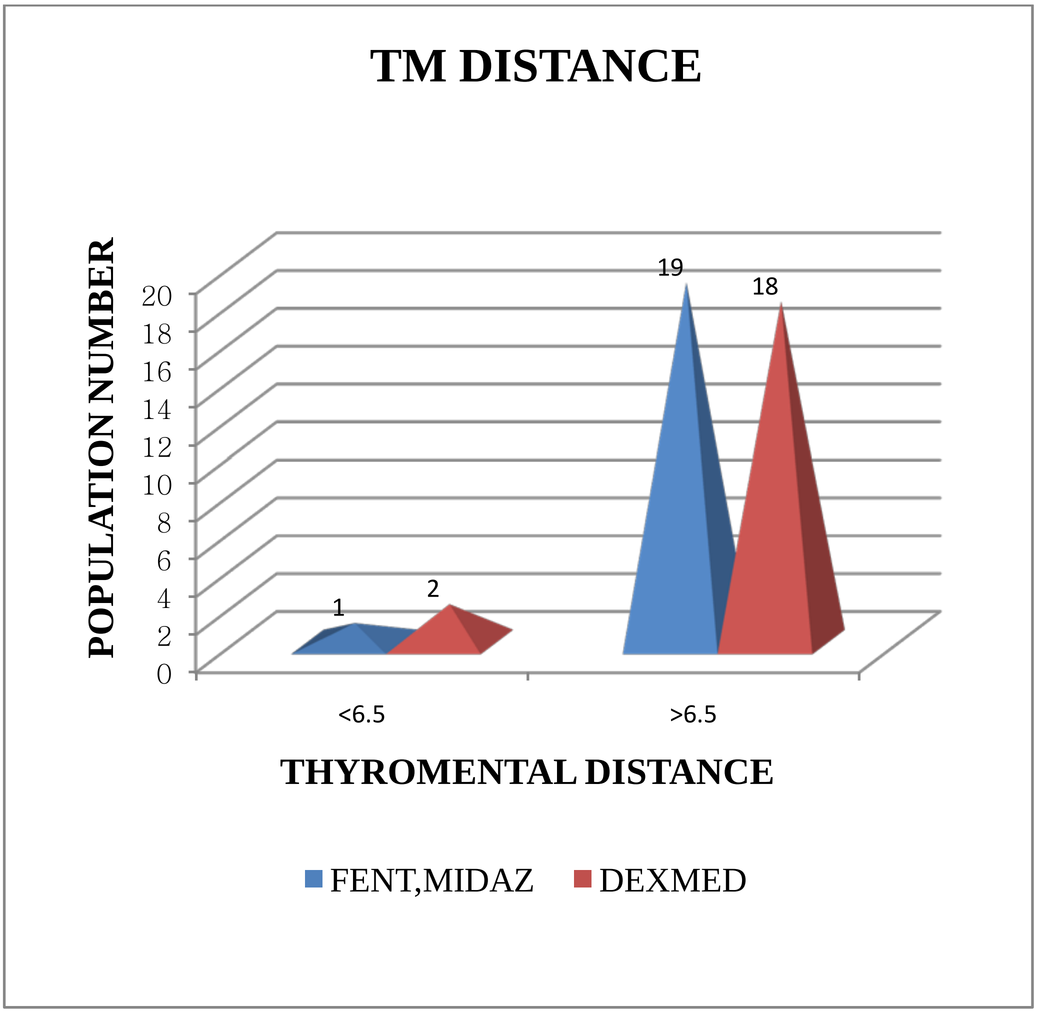
The difference in height, weight, BMI of the study population between the two study groups were comparable but not statistically significant

Figure 20 : Comparing the distribution of population based on their Mallampatti airway class



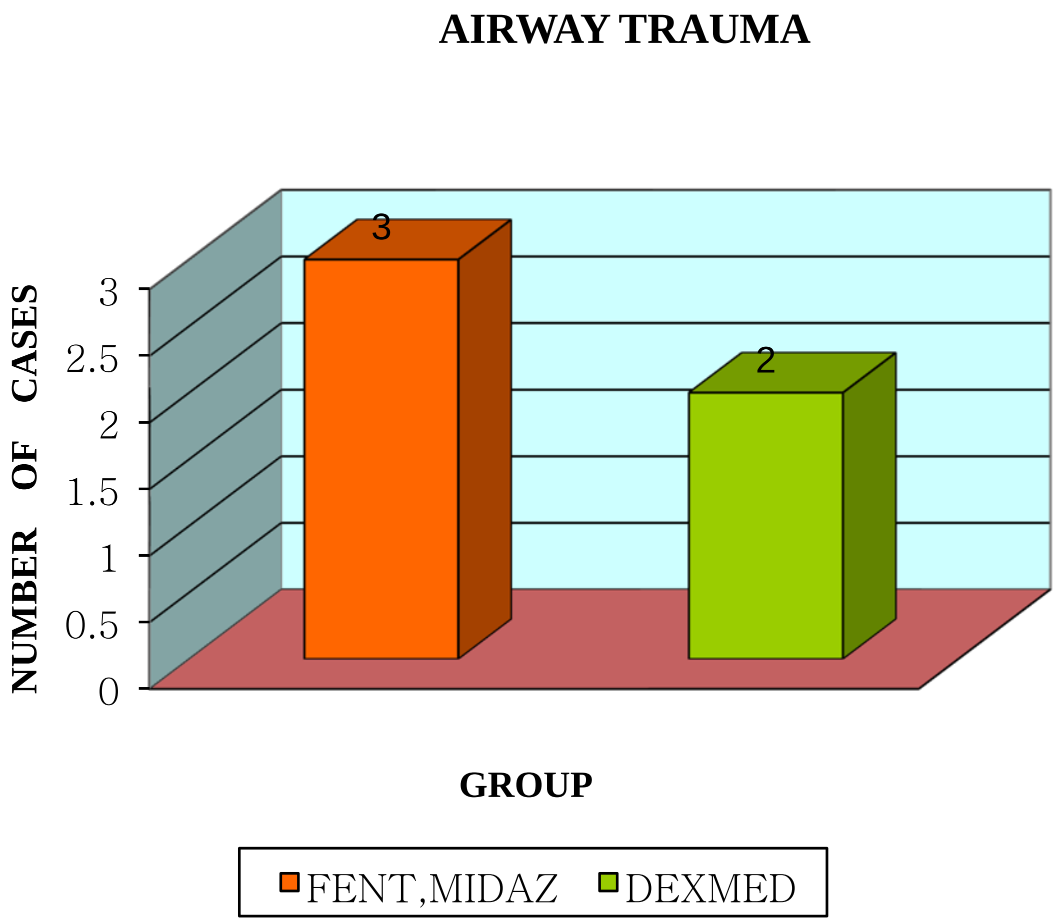
Fifty percent of the population in our study group belong to Mallampatti class 1, above 40 percent to class 2 and remaining to class 3. None of our study population belonged to Malllampatti class four airway.

Figure 21 : Comparing the distribution of population based on thyromental distance



Over 90 percentage of our population had TMD > 6.5

Figure 22 : Comparing the incidence of airway injury between the two groups



Ninety five percent and ninety percent of the population did not have airway trauma in group D and group FM respectively .

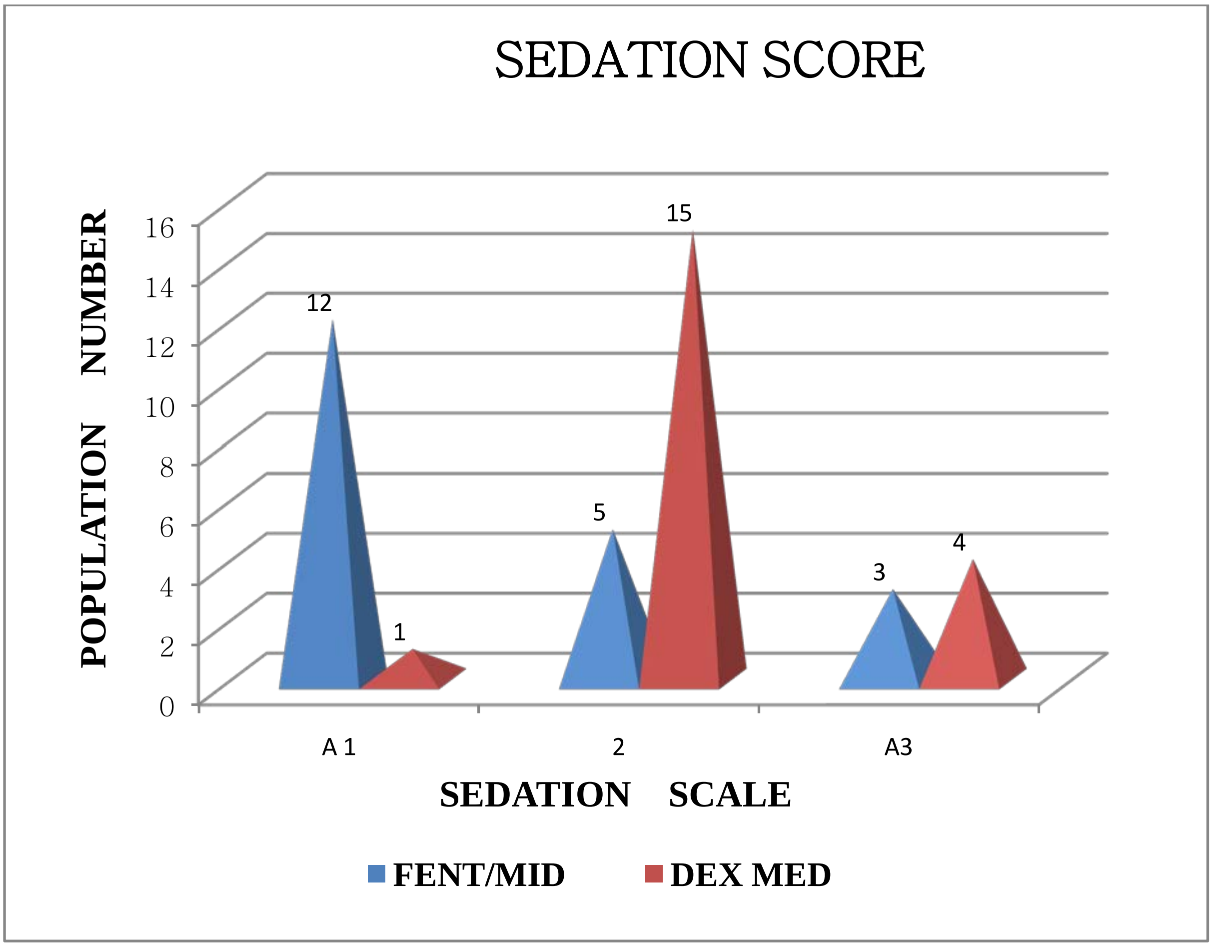
Statistical significance existed between two groups in terms of

- Intubation time in seconds
- Sedation scale
- Comfort score
- Hemodynamic variables

Table 5 – Comparison of sedation scale between two groups

GROUP	Mean	SD	P value	T value
Fent&Midaz	1.55	0.76	0.005	2.97
Dexmed	2.15	0.49		

Figure 23 : Comparing the sedation scale achieved between the two groups

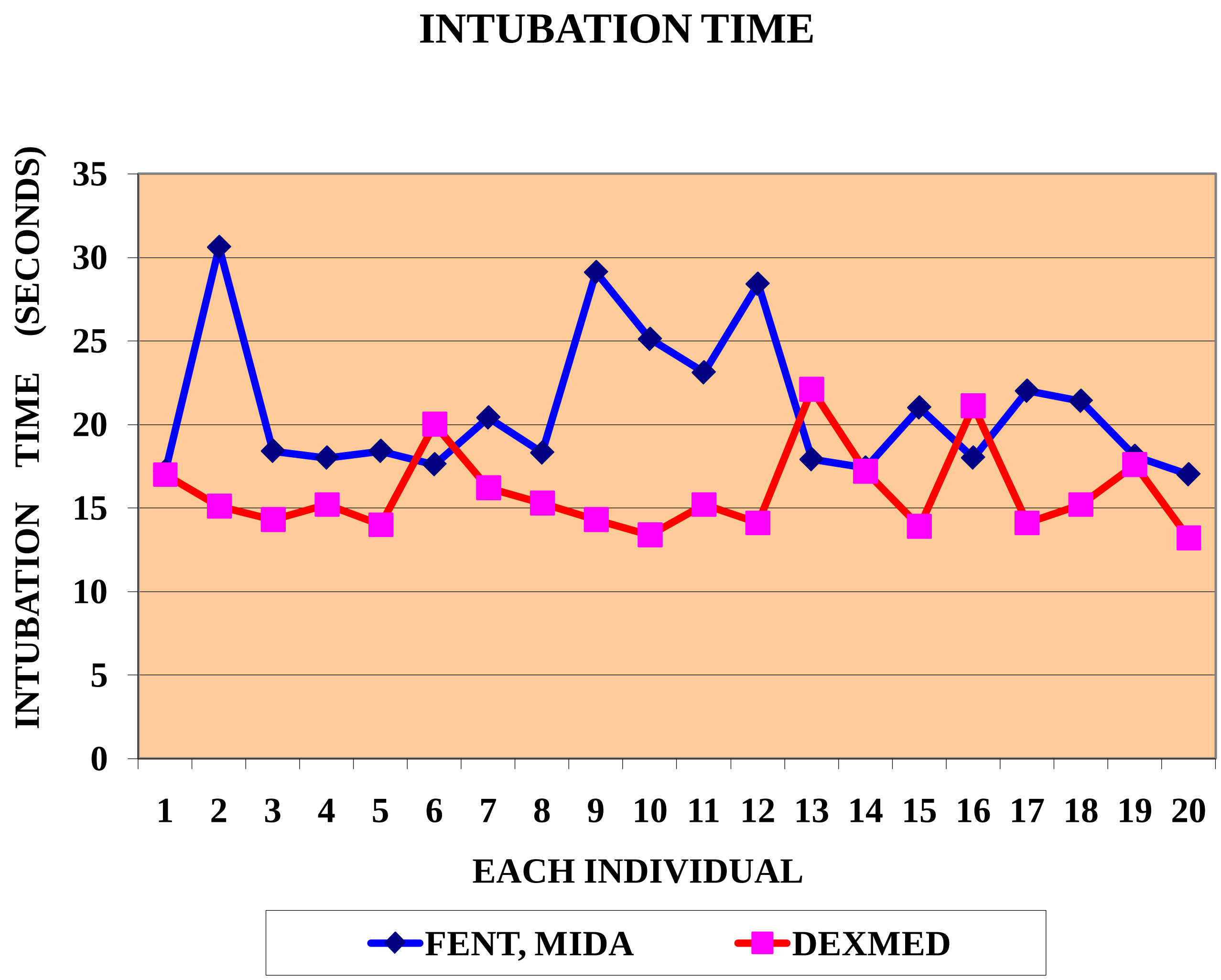


Dexmedetomidine group had a better sedation score when compared with fentanyl midazolam group. The sedation score was adequate providing the patient with anxiolysis and a good conscious sedation with amnesia as well.

Table 6 – Comparison of Intubation time between two groups

GROUP	Mean	SD	P value	T value
Fent&Midaz	20.87	4.27	<0.001	4.45
Dexmed	15.92	2.56		

Figure 24 : Showing the comparison of Intubation time between two groups

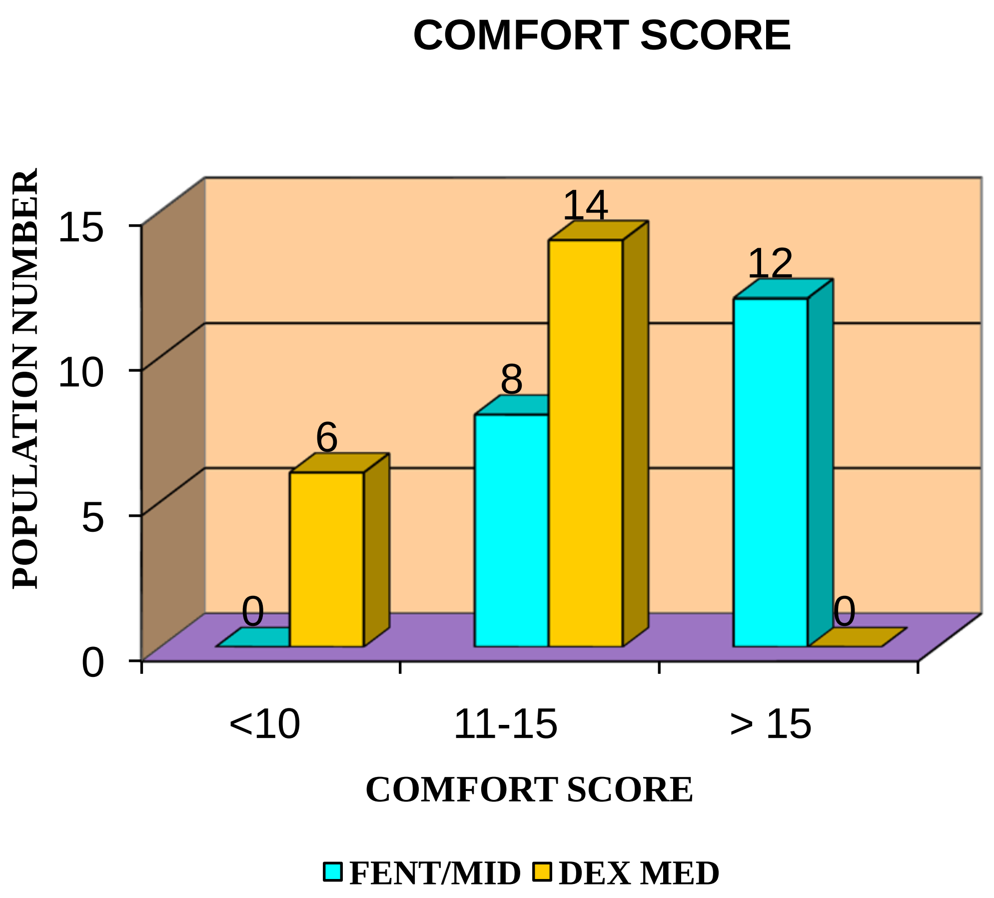


Except for 3 patients, the intubation time was less in dexmedetomidine group whencompared with fentanyl-midaz group with statistical significance (P value being<0.001)

Table 7 – Showing the comparison of comfort score between two groups

GROUP	Mean	SD	P value	T value
Fent&Midaz	15.95	1.73	<0.001	9.82
Dexmed	11.3	1.22		

Figure 25 : Comparing comfort score level between two groups achieved by each patient



Dexmedetomidine group patients were better comfortable with the procedure than fentanyl midazolam group . Comfort score was calculated out of 35 based on 7 entities . Dexmed group had a mean value of 11.3 when compared with fentanyl midazolam group which had a mean value of 15.95

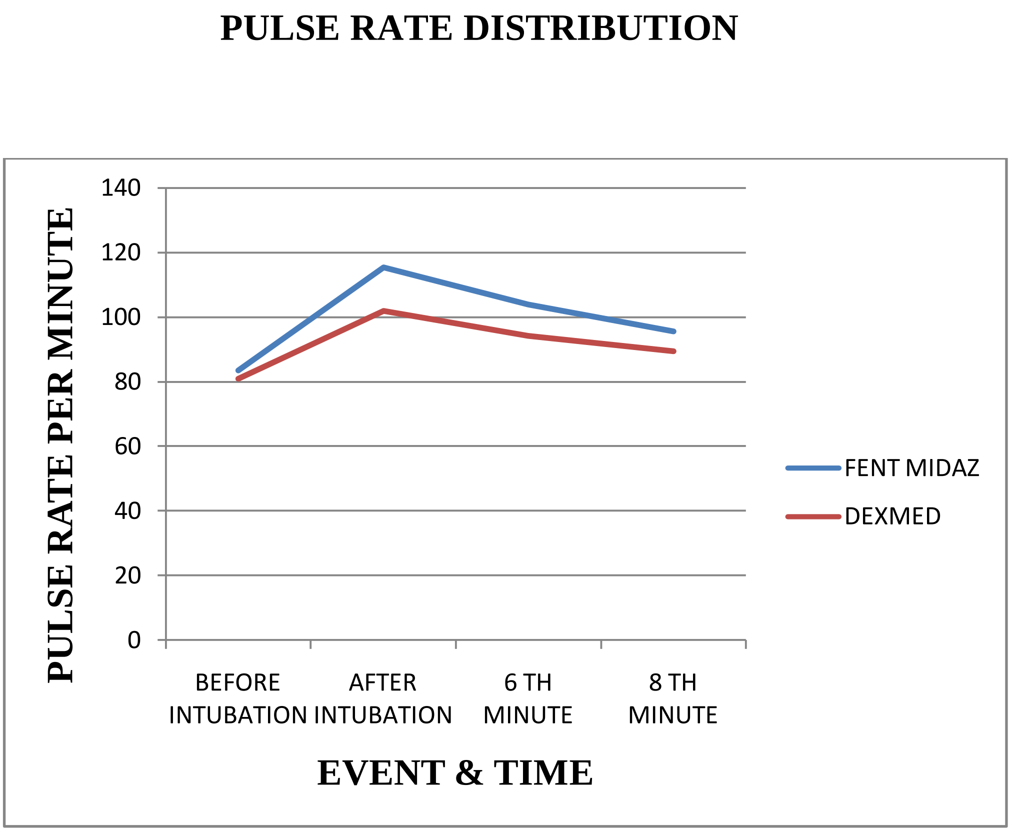
(lower the comfort score , better the patient was)

In case of hemodynamic variables again dexmedetomidine group patients had a better hemodynamic scores than fentanyl midazolam group patients.

Table 8 – Comparison of pulse rate scores between two groups

TIME	FENT&MIDAZ		DEXMED			
	Mean	SD	Mean	SD	P value	T value
Base line	84.6	8.78	82.95	11.66	0.616	0.505
Before Intubation	83.5	6.76	81	7.64	0.28	1.09
After intubation	115.4	9.03	101.9	9.39	<0.001	4.63
6th min	103.9	11.36	94.25	9.65	0.006	2.89
8th min	95.55	8.13	89.55	7.84	0.023	2.37
10th min	85.2	10.47	82.4	7.79	0.343	0.96

Fig 26 : Line graph showing pulse rate variations among two groups

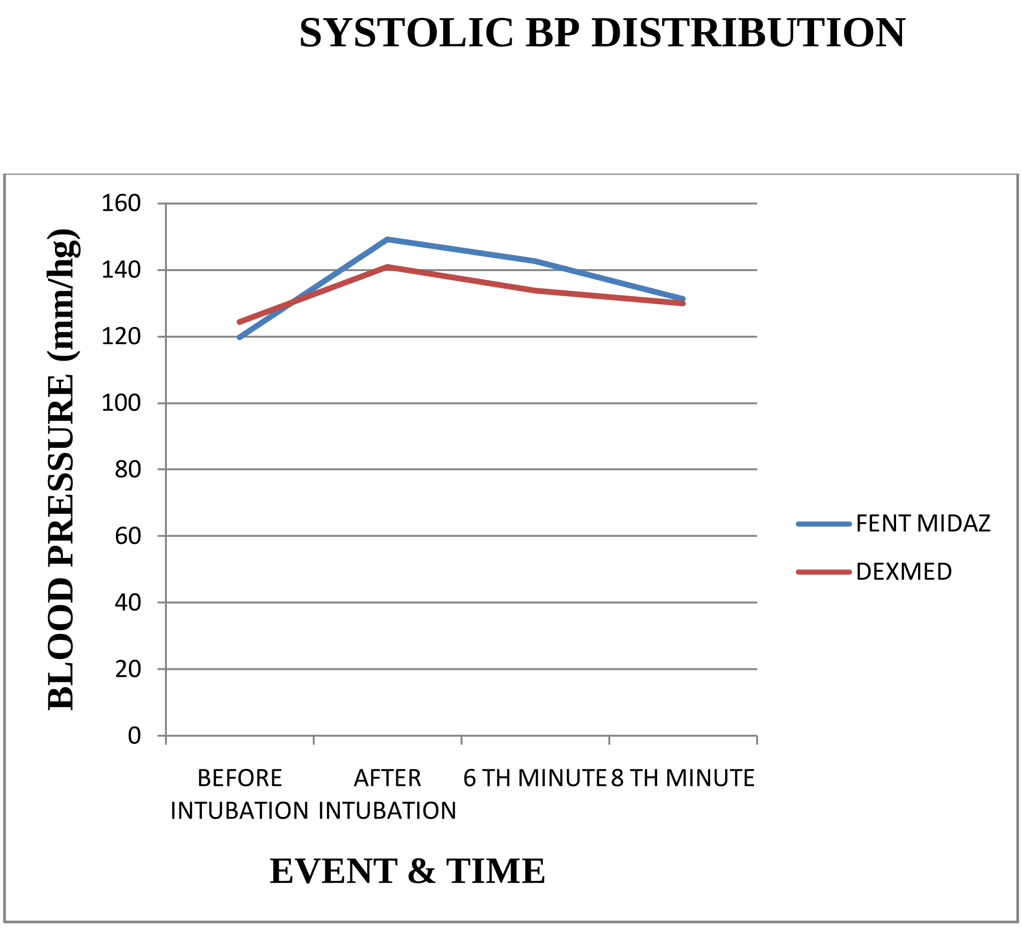


After intubaion , 6 th and 8 th minute pulse rate scores were statistically significant with P value being <0.001 , 0.006 , 0.023 respectively

Table 9 – Comparison of systolic BP scores between two groups

TIME	FENT,MIDAZ		DEXMED			
	Mean	SD	Mean	SD	**P value**	T value
Base line	125.8	16.72	126.05	13.97	**0.959**	0.051
Before Intubation	119.75	15.01	124.35	14.05	**0.323**	1.001
After intubation	149.25	12.47	140.95	15.01	**0.065**	1.902
6th min	142.6	14.73	133.75	12.37	**0.047**	2.06
8th min	131.4	17.03	129.9	9.86	**0.744**	0.329
10th min	122.75	20.79	126	13.33	**0.562**	0.586

Fig 27 : Comparing systolic BP variations between two groups

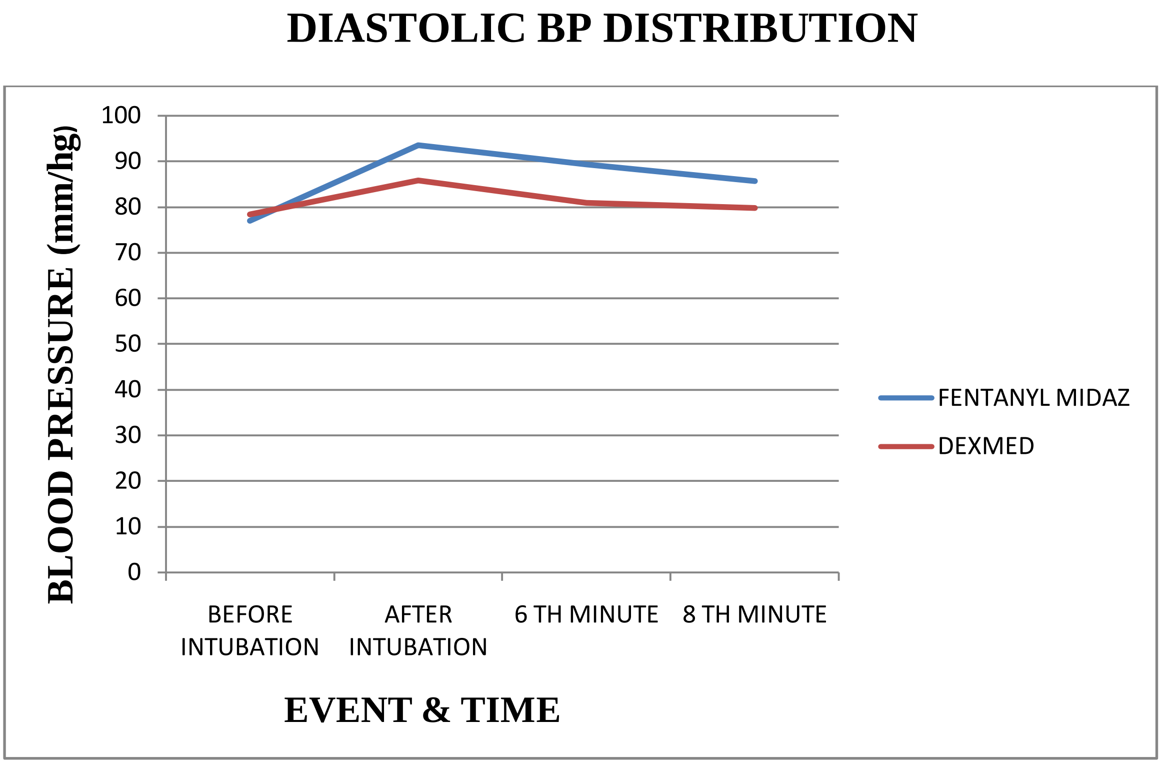


After intubation and 6 th minute scores were statistically significant

Table 10 – Comparison of diastolic BP scores between the two groups

TIME	FENT,MIDAZ		DEXMED			
	Mean	SD	Mean	SD	P value	T value
Base line	81.9	13.56	78.3	10.33	0.351	0.945
Before Intubation	76.9	11.25	77.35	12.99	0.907	0.117
After intubation	93.55	13.97	85.8	9.6	0.037	2.16
6th min	89.3	13.45	80.8	11.15	0.036	2.17
8th min	85.6	12.83	79.75	9.78	0.113	1.62
10th min	79	15.54	75.65	10.06	0.424	0.809

Fig 28 : Comparing diastolic BP variations between the 2 groups

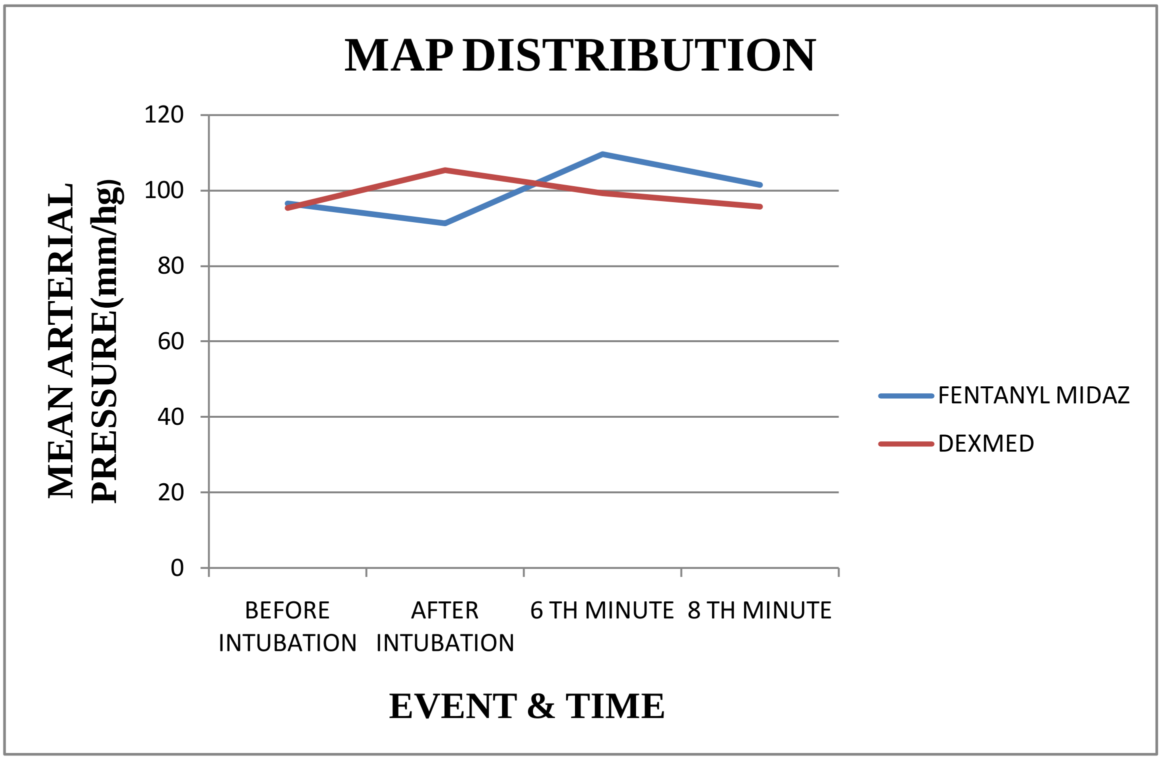


After intubation & 6 th minute scores were statistically significant with P value being 0.037 & 0.036 respectively.

Table 11 - Comparing MAP(mean arterial pressure) between the two groups

TIME	FENT,MIDAZ		DEXMED			
	Mean	SD	Mean	SD	P value	T value
Base line	96.5	15.02	92.3	21.84	0.483	0.709
Before Intubation	91.3	11.92	95.4	14.01	0.325	0.997
After intubation	116.55	14.45	105.5	12.5	0.014	2.58
6th min	109.6	15.86	99.2	11.5	0.023	2.37
8th min	101.4	15.56	97.9	9.09	0.39	0.869
10th min	93.65	18.37	93.6	10.04	0.992	0.011

Fig 29 : Comparing MAP variations between two groups

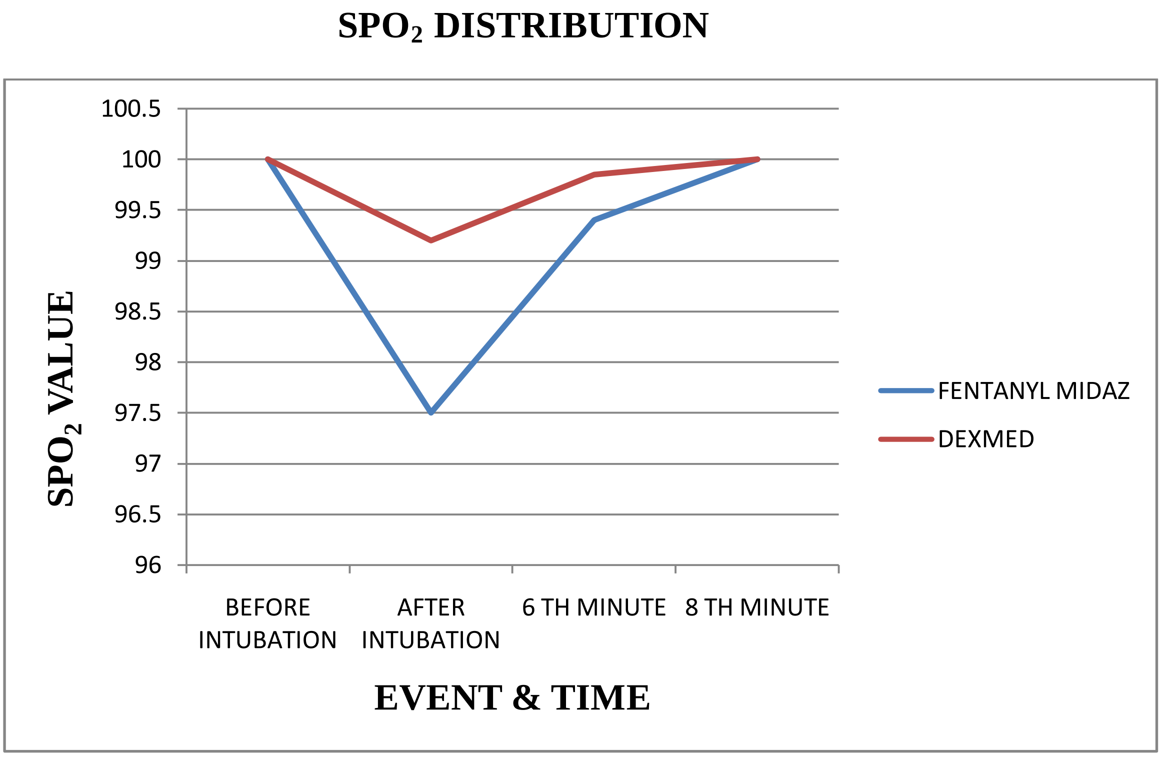


After intubation & 6 th minute values were significant with P value being 0.014 & 0.023 respectively .

Table 12 Comparison of Spo_2 scores between the two groups

TIME	FENT MIDAZ		DEXMED			
	Mean	SD	Mean	SD	P value	T value
Base line	100		100		1	
Before Intubation	100		100		1	
After intubation	97.5	2.67	99.2	1.74	0.022	2.38
6th min	99.4	0.41	99.85	0.49	0.003	3.15
8th min	100		100		1	
10th min	100		100		1	

Fig 30: Showing SpO_2 variations between two groups



After intubation & 6 th minute were statistically significant with P value being 0.022 & 0.003 respectively .

DISCUSSION

Awake fibreoptic intubation, one of the modalities in difficult airway management is an unpleasant procedure which definitely needs an ideal sedative regimen satisfying patient in all aspects by providing adequate analgesia, amnesia, anxiolysis, anti-sialogogue, better respiratory and hemodynamic parameters .

Fentanyl midazolam combination may provide adequate analgesia,amnesia,anxiolysis but is known to produce apnea and hypoxemia even in healthy volunteers . But dexmedetomidine, a recently introduced drug, an alpha 2 adrenoreceptor aganist seems to be satisfying all the patient needs in all aspects.

In view of existing controversies and lack of consensus in previous literatures , this study was carried out over a one year period with the principal aim of comparing dexmedetomidine alone with fentanyl- midazolam combination as an ideal agent for providing sedation for AFOI.

In this study we have shown that Dexmedetomidine convincingly is a superior & better drug in terms of providing sedation for awake fibreoptic intubation in all aspects. The plane of sedation provided by this drug was excellent such that it neither produced a deep sedation making the patient well asleep depressing his respiration nor a superficial plane where the patient is anxious and agitated. It was an intermediate plane where the patient is conscious, responding to commands, calm with a better hemodynamics and respiratory parameter.

Quoting others literature, Bergese et al in his study has shown that Patients belonging to dexmedetomidine group were more satisfied and comfortable than the midazolam group.

Further in our study dexmedetomidine group patient had better comfort score when compared with fentanyl midazolam group. Comfort score was calculated based on 7 parameters, which were calmness, alertness, crying, physical movement, respiratory response, Facial tension and muscle tone. The lower the score, the better the patient was.

Also the patients belonging to dexmedetomidine group had less airway trauma when compared with fentanyl midazolam indicating group D patients were better prepared for the procedure.

Intubation time in dexmedetomidine group patients was faster when compared with fentanyl midazolam group which tells that Group D patients were easier to intubate as they were more cooperative and calm.

Dexmedetomidine group patients also had better hemodynamics when compared with fentanyl midazolam group.

Further Dexmedetomidine group had better respiratory parameters in terms of SpO2. Midazolam especially in combination with fentanyl is known for its respiratory depression and decrease in SpO2 whereas dexmedetomidine group has respiratory sparing effect even in high doses. Bailey et al too had quoted in his literature that fentanyl midazolam combination produces respiratory depression and hypoxia.

Kamibyashi et al has quoted that dexmedetomidine has additional antisialogogue effect making intubation easier and intubation time shorter.

Table 13 : Comparison of similar studies

STUDY	**INFERENCE**
Bailey et al	Fentanyl and midazolam use has produced significant hypoxia and apnea even in healthy adult volunteers.
Bergese et al	Dexmedetomidine group patients were more calmer , cooperative and satisfied when compared with others.
Tsai et al	Respiratory depression is lesser with dexmedetomidine group when compared with propofol group.
Avitsian et al	Dexmedetomidine had better intubating conditions in patients with cervical spine injury.
Chu et al	In oral cancers for whom intubation was difficult , dexmedetomidine was very much efficacious.
Bloor et al	Dexmedetomidine has a biphasic blood pressure response, initial hypertension due to vasoconstriction of peripheral vessels.

LIMITATIONS

Our study was limited by small sample size.

The choice of route for intubation was decided to be nasotracheal, had it been orotracheal it would have been more comfortable for the patients and the parameters like comfort scores and hemodynamic variables would have been better.

CONCLUSION

We conclude that dexmedetomidine is a safe and highly efficacious drug in providing sedation , amnesia , anxiolysis , analgesia , better hemodynamics without producing respiratory depression for awake fibreoptic intubation..

We also conclude that ease of intubation, cough suppression, comfort score & sedation scale was better with Dexmedetomidine .

REFERENCES :

1) Bhana N, Goa KL, McClellan KJ. Dexmedetomidine Drugs. 2000 Feb;59(2):263-8

2) Martin E, Ramsay G, Mantz J. The role of the alpha2-adrenoceptor Agonist dexmedetomidine in postsurgical sedation in the intensive care unit. Journal of Intensive Care Med. 2003 Jan-Feb;18(1):29

3) Kamibayashi T and Maze M. Clinical uses of alpha -2 adrenergic agonists. Anesthesiology 2000;93:1345-9.

4) Boyd BC and Sutter SJ. Dexmedetomidine sedation for awake fiberoptic Intubation of patients with difficult airways due to severe odontogenic cervicofacial infections. J Oral Maxillofac Surg. 2011 Jun;69(6):1608-12. doi: 10.1016/j.joms.2010.11.004. Epub 2011 Mar 9.

5) Grant SA, Breslin DS, MacLeod DB. Dexmedetomidine infusion for Sedation during fiberoptic intubation: A report of three cases. Journal of Clinical Anaesthesia 2004 16: 124

6) Bergese SD, Bebder SP, Mc Sweeney BS. A comparative study of dexmedetomidine with midazolam and midazolam alone for sedation during elective awake fiberoptic intubation. Journal of Clinical Anaesthesia 2010: 22: 35-40.

7)Avitsan R, Lin J, Lotto M. Dexmedetomidine and awake fiberoptic intubation for possible cervical spine myelopathy. J Neurosurg Anaesthesiology 2005; 17: 97-

8) Bergese SD, Khabiri B, Roberts WD, Howie MB, McSweeney TD, Gerhardt MA. Dexmedetomidine for conscious sedation in difficult awake fiberoptic intubation cases. J Clin Anesth 2007; 19:141–4.

9) Hall JE, Uhrich TD, Barney JA, Arain SR, Ebert TJ. Sedative, amnestic, and analgesic properties of small-dose dexmedetomidine infusions. Anaesth Analg 2000; 90:699–05.

10) Ramsay MAE, Luterman DL. Dexmedetomidine as a total intravenous anaesthetic agent. Anaesthesiology 2004; 101:787–90.

11)Bergese SD, Khabiri B, Roberts WD, Howie MB, McSweeney TD, Gerhardt MA. Dexmedetomidine for conscious sedation in difficult awake fiberoptic intubation cases. J Clin Anesth 2007; 19:141–4.

12) Grant SA, Breslin DS, Macleod DB, Gleason D, Martin G. Dexmedetomidine infusion for sedation during fiberoptic intubation: a report of three cases. J Clin Anesth 2004; 16:124-6.

13) Abdelmalak B, Makary L, Hoban J, Doyle DJ. Dexmedetomidine as sole sedative for awake intubation in management of critical airway. J Clin Anesth 2007; 19:370–3.

14) Neumann MM, Davio MB, Macknet MR, Applegate RL II. Dexmedetomidine for awake fiberoptic intubation in a parturient with spinal muscular atrophy type III for cesarean delivery. Int J Obstet Anesth 2009; 18:403–7.

15) Madhere M, vangura D, Saidov A. Dexmedetomidine as sole agent for

Awake fiberoptic intubation in a patient with local anesthetic allergy. J Anesth 2011;10:1007.

16) Tsai CJ, Chu KS, Chen TI, Lu DV, Wang HM, Lu IC. A comparison of the effectiveness of dexmedetomidine versus propofol target-controlled infusion for sedatoin during fiberoptic nasotracheal intubation. Anaesthesia 2010;65:254–9.

17) Kim YY. Sedation for fiberoptic awake nasotracheal intubation: Comparison between propofol infusion and intravenous boluses of fentanyl and midazolam. Korean J Anesthesiol 1997; 33:741–9.

18) Nelson LE, You T, Maze M, Franks NP. Evidence that the mechanism of hypnotic action in dexmedetomidine and muscimol-induced anesthesia converges on the endogenous sleep pathway. Anesthesiology 2001; 95:368.

19) Rozet I. Anesthesia for functional neurosurgery: the role of dexmedetomidine. Curr Opin Anesthesiol 2008; 21:537–43.

20) Venn RM, Bradshaw CJ, Spencer R, Brealey D, Caudwell E, Naughtan C,et al. Preliminary UK experience of dexmedetomidine: a novel agent for postoperative sedation in the intensive care unit. Anaesthesia 1999;54:1136–42.

21) Bloor BC, Ward DS, Belleville JP, Maze M. Effects of intravenous Dexmedetomidine in humans. Anaesthesiology 1992; 77:1134–42.

22) Ebert TJ, Hall JE, Barney JA, Uhrich TD, Colinco MD. The effects of Increasing plasma concentrations of dexmedetomidine in humans.

Anaesthesiology 2000; 93:82–94.

23) Ebert T, Maze M. Dexmedetomidine: another arrow for the clinician's quiver. Anaesthesiology 2004; 101:568–70.

24) Jorden VS, Pousman RM, Sanfor MM, Thorborg PA, Hutchens MP. Dexmedetomidine overdose in the perioperative setting. Ann Pharmacother 2004;38:803–7.

25) Avitsian R, Manlapaz M, Doyle DJ. Dexmedetomidine as a sedative for awake fiberoptic intubation. International Trauma Care (ITACCS) 2007; 17:19–24.

COMPARISON BETWEEN DEXMEDETOMIDINE AND A COMBINATION OF MIDAZOLAM AND FENTANYL FOR SEDATION DURING AWAKE FIBEROPTIC INTUBATION – A PROSPECTIVE,RANDOMIZED, PARALLEL GROUP, DOUBLE-BLINDED STUDY

PROFORMA

Name :	Age :
Diagnosis :	ASA status :

PATIENT EVALUATION :

Pulse :	BP :
RR :	Airway :
CVS :	RS :

INVESTIGATIONS :

Hb% :	RBS :
BT :	CT :
Blood Urea :	Ser Creatinine :

Blood Grouping & typing :

GROUP		GROUP D GROUP FM
SEDATION SCALE	:	0/1/2/3
INTUBATION SCORE	:	0/1/2/3
COMFORT SCORE (Out of 35)	:	
AIRWAY TRAUMA	:	YES / NO
INTUBATION TIME (In seconds)	:	

HEMODYNAMIC VARIABLES

TIME	DRUG& DOSE	H/R	BP SYSTOLIC	BP DIASTOLIC	BP MEAN	SpO2	RR

MASTER CHART

S.No.	Age Yrs	Sex	Wt. Kg	Ht. cm	BMI	ASA	MPC	TM Distance cm	PR						SYS. BP					
									Base Line 0 min.	Before Intubation 2nd min.	After Intubation 4th min.	6th min.	8th min.	10th min.	Base Line 0 min.	Before Intubation 2nd min.	After Intubation 4th min.	6th min.	8th min.	10th min.
1	30	F	42	160	16.4	*1*	1	> 6.5	86	80	108	102	98	90	120	120	156	137	116	113
2	42	M	65	170	22.5	*1*	3	> 6.5	88	80	128	17	105	90	127	121	163	149	143	136
3	50	F	55	164	20.4	1	2	> 6.5	80	82	118	108	101	82	149	143	172	158	139	132
4	28	M	72	170	24.9	1	1	> 6.5	76	70	98	90	86	82	145	98	150	133	129	120
5	32	F	51	163	15.2	1	2	> 6.5	72	80	102	82	80	72	123	127	136	122	121	112
6	35	M	76	176	24.5	1	1	> 6.5	86	90	117	101	98	86	147	123	139	147	142	134
7	63	M	60	169	21	1	1	> 6.5	90	90	108	104	94	92	130	131	163	149	135	136
8	20	F	40	160	15.6	1	1	> 6.5	92	86	112	110	16	92	100	106	147	142	100	96
9	43	M	80	170	27.7	1	2	> 6.5	86	88	130	124	112	106	134	137	156	156	150	140
10	25	M	74	172	25	1	3	> 6.5	80	90	120	122	106	112	92	90	134	132	127	91
11	30	F	60	56	24.7	1	2	> 6.5	83	85	104	96	98	80	118	113	131	132	101	98
12	40	F	70	160	27.3	1	2	< 6.5	84	92	114	98	94	82	131	131	199	162	141	145
13	32	M	73	173	24.4	1	1	> 6.5	76	70	117	90	86	78	137	131	149	140	135	101
14	65	M	52	165	19.1	1	2	> 6.5	72	74	112	92	82	74	156	143	199	164	159	156
15	30	F	72	160	28.1	1	2	> 6.5	78	82	110	94	98	68	125	113	156	143	120	120
16	18	F	40	156	16.4	1	1	> 6.5	90	88	120	112	100	90	113	118	131	133	118	113
17	53	M	75	164	27.9	1	2	> 6.5	112	88	120	104	89	80	123	104	195	197	164	156
18	36	F	69	166	25	1	2	> 6.5	90	93	114	114	90	86	129	131	156	162	141	150
19	37	M	75	172	25.4	1	1	> 6.5	86	80	126	108	98	82	101	99	145	116	116	103
20	23	F	48	164	17.8	1	1	> 6.5	85	82	130	120	100	80	116	116	128	118	131	103
21	40	F	68	164	25.3	1	2	> 6.5	72	82	104	98	90	70	140	132	140	133	131	129
22	32	M	73	170	25.3	1	1	> 6.5	78	70	98	87	80	81	122	127	145	131	120	128
23	65	M	60	169	21	1	1	> 6.5	84	86	108	97	91	87	141	149	156	151	141	137
24	62	F	43	150	19.1	1	1	> 6.5	86	90	112	90	94	82	98	87	101	99	113	91

25	28	F	42	154	17.7	1	1	> 6.5	80	87	100	9	81	74	120	113	131	118	120	116
26	48	F	80	160	31.2	1	2	< 6.5	82	77	114	112	99	90	128	118	143	134	134	137
27	29	M	78	172	26.4	1	2	> 6.5	76	75	90	72	74	76	120	129	141	125	129	129
28	25	M	80	173	26.7	1	2	> 6.5	74	70	88	84	86	76	101	98	120	131	122	123
29	43	F	60	165	22	1	1	> 6.5	82	84	100	92	88	80	135	136	154	147	142	136
30	44	F	45	160	17.6	1	2	> 6.5	88	90	98	90	92	92	143	137	156	150	143	135
31	29	M	73	169	25.6	1	1	> 6.5	98	80	88	83	80	70	113	118	129	120	128	118
32	41	M	80	172	27	1	2	> 6.5	98	92	106	110	104	98	133	135	149	141	137	133
33	32	M	81	170	28	1	3	> 6.5	9	95	110	98	97	88	131	120	135	137	125	128
34	33	F	43	162	16.4	1	1	> 6.5	86	80	98	100	90	82	127	125	149	140	136	135
35	25	F	49	163	18.4	1	1	> 6.5	72	72	90	92	88	78	126	127	164	143	149	131
36	50	M	52	168	18.4	1	2	> 6.5	108	80	120	104	102	92	113	122	131	133	116	120
37	28	F	35	154	14.8	1	1	> 6.5	96	82	96	88	82	76	110	118	125	128	118	91
38	32	M	74	173	24.7	1	1	> 6.5	70	84	98	90	88	85	131	125	145	128	129	135
39	50	F	74	160	28.9	1	2	> 6.5	68	70	116	104	97	91	140	139	156	141	135	136
40	48	M	85	165	31.2	1	1	< 6.5	65	74	104	102	88	80	149	132	149	145	131	132

MASTER CHART (Contd . . .)

DIA. BP						MAP						SPO2						Intubation Time sec.
Base Line 0 min.	Before Intubation 2nd min.	After Intubation 4th min.	6th min.	8th min.	10th min.	Base Line 0 min.	Before Intubation 2nd min.	After Intubation 4th min.	6th min.	8th min.	10th min.	Base Line 0 min.	Before Intubation 2nd min.	After Intubation 4th min.	6th min.	8th min.	10th min.	
74	76	112	85	77	70	89	92	130	104	89	83	100	100	100	100	100	100	17.2
82	72	100	93	98	78	99	91	129	115	121	84	100	100	922	100	100	100	30.6
95	97	113	112	99	84	122	13	132	127	112	103	100	100	100	100	100	100	18.4
90	62	100	78	85	74	117	71	117	97	99	89	100	100	100	100	100	100	18
80	80	58	75	74	72	93	95	84	91	91	89	100	100	98	100	100	100	18.4
94	80	99	94	90	85	112	93	112	112	101	100	100	100	99	100	100	100	17.6
78	78	100	93	58	58	101	99	129	115	102	84	100	100	98	100	100	100	20.4
55	61	94	90	58	56	73	79	112	101	72	71	100	100	100	100	100	100	18.3
85	100	102	100	96	96	106	104	121	130	117	112	100	100	90	100	100	100	29.1
48	72	74	79	80	60	67	78	98	99	97	72	100	100	92	100	100	100	25.1
65	70	83	82	69	62	84	83	102	101	81	77	100	100	99	100	100	100	23.1
83	80	99	105	96	90	102	100	122	126	112	117	100	100	99	100	100	100	28.4
85	80	93	84	86	69	104	100	115	107	103	81	100	100	100	99	100	100	17.9
100	97	99	103	105	112	121	113	122	127	129	130	100	100	99	99	100	100	17.4
120	77	70	100	97	74	95	83	121	113	89	89	100	100	98	99	100	100	2.1
70	65	83	78	65	70	83	83	102	97	83	83	100	100	100	100	100	100	18
80	63	106	10	103	112	95	79	136	136	127	130	100	100	100	100	100	100	22
85	83	112	105	96	100	99	102	136	128	112	117	100	100	97	100	100	100	21.4
69	68	90	65	77	69	81	79	117	83	89	81	100	100	98	99	100	100	18.1
70	77	74	65	83	69	87	89	94	83	102	81	100	100	99	100	100	100	17
89	84	88	78	80	85	10	103	105	97	100	99	100	100	100	100	100	100	17
78	93	90	83	74	74	96	108	117	102	89	94	100	100	100	100	100	100	15.1
96	99	112	97	96	85	112	122	136	115	112	104	100	100	99	100	100	100	14.3

62	56	69	68	70	60	77	66	81	79	83	72	100	100	100	100	100	100	15.2
76	70	80	65	76	77	92	83	100	84	92	89	100	100	100	100	100	100	14
74	65	98	97	74	85	94	84	121	105	98	104	100	100	94	98	100	100	20
74	85	96	112	77	85	89	99	95	99	87	99	100	100	100	100	100	100	16.2
69	62	74	83	78	80	81	77	89	102	96	95	100	100	98	100	100	100	15.3
58	58	94	94	90	58	102	184	128	112	101	84	100	100	100	100	100	100	14.3
97	85	112	100	97	78	113	104	136	117	113	99	100	100	100	100	100	100	13.4
70	65	85	76	77	65	83	84	99	92	95	84	100	100	100	100	100	100	15.2
78	78	99	96	855	78	97	99	122	112	104	101	100	100	100	100	100	100	14.1
80	76	78	85	77	74	100	92	99	104	95	94	100	100	95	99	100	100	22.1
79	101	93	89	83	86	97	116	115	110	102	103	100	100	100	100	100	100	17.2
80	80	103	98	93	83	101	97	127	121	115	102	100	100	100	100	100	100	13.9
71	75	83	78	77	74	91	81	102	97	89	89	100	100	98	100	100	100	21.1
76	65	77	74	65	60	92	83	95	94	84	72	100	100	100	100	100	100	14.1
78	77	90	74	85	86	99	95	117	94	99	103	100	100	100	100	100	100	15.2
88	89	112	96	58	58	105	108	136	112	102	84	100	100	100	100	100	100	17.6
93	84	95	90	83	82	115	103	122	117	102	101	100	100	100	100	100	100	13.2

MASTER CHART (Contd . . .)

Airway Trauma Yes/No	DRUG GIVEN	SEDATION SCALE	COMFORT SCORES: ALERTNESS CALMNESS RESPIRATORY RESPONSE CRYING PHYSICAL MOVEMENT MUSCLE TONE FACIAL TENSION TOTAL (OUT OF 5)	CALMNESS (OUT OF 5)	RESPIRATORY RESPONSE (OUT OF 5)	CRYING (OUT OF 5)	PHYSICAL MOVEMENT (OUT OF 5)	MUSCLE TONE (OUT OF 5)	FACIAL TENSION OUT OF 5)	TOTAL (OUT OF 35)
NO	FENT,MIDAZ	1	3.00	2	3	2	1	2	3	13
YES	FENT,MIDAZ	2	2.00	2	3	2	2	2	3	14
NO	FENT,MIDAZ	2	2.00	2	3	4	1	2	2	14
NO	FENT,MIDAZ	1	2.00	3	3	3	2	3	2	16
NO	FENT,MIDAZ	1	2.00	3	4	2	1	3	2	15
NO	FENT,MIDAZ	3	3.00	1	4	3	2	1	1	12
NO	FENT,MIDAZ	1	3.00	3	4	1	3	1	1	13
NO	FENT,MIDAZ	1	3.00	2	3	1	3	3	3	15
NO	FENT,MIDAZ	3	3.00	3	3	1	1	3	2	13
YES	FENT,MIDAZ	2	2.00	2	3	4	2	3	3	17
NO	FENT,MIDAZ	2	3.00	3	4	4	1	1	2	15
NO	FENT,MIDAZ	1	3.00	2	4	2	2	2	2	14
NO	FENT,MIDAZ	1	2.00	2	4	2	1	2	2	13
NO	FENT,MIDAZ	1	2.00	2	3	2	2	3	1	13
NO	FENT,MIDAZ	1	3.00	2	3	2	1	3	1	12

NO	FENT,MIDAZ	3	2.00	1	3	2	2	3	1	12
NO	FENT,MIDAZ	1	2.00	1	3	2	1	2	2	11
YES	FENT,MIDAZ	1	3.00	3	3	3	2	2	2	15
NO	FENT,MIDAZ	1	2.00	2	2	3	1	1	2	11
NO	FENT,MIDAZ	2	2.00	2	2	3	2	1	2	12
NO	DEXMED	2	3.00	1	2	1	1	1	1	7
NO	DEXMED	2	3.00	1	2	1	2	1	1	8
NO	DEXMED	2	2.00	2	2	1	2	1	2	10
NO	DEXMED	2	3.00	1	2	1	1	1	2	8
NO	DEXMED	2	3.00	1	2	1	1	1	1	7
NO	DEXMED	1	2.00	2	2	1	1	1	1	8
NO	DEXMED	3	3.00	2	3	2	2	2	1	12
NO	DEXMED	3	3.00	1	2	1	2	2	1	9
NO	DEXMED	3	2.00	2	2	1	1	2	2	10
YES	DEXMED	2	3.00	1	2	1	1	2	1	8
NO	DEXMED	2	2.00	1	2	1	1	1	2	8
NO	DEXMED	2	3.00	1	2	1	3	1	1	9
YES	DEXMED	2	2.00	1	2	1	1	1	2	8
NO	DEXMED	2	3.00	2	2	1	1	1	1	8
NO	DEXMED	2	3.00	3	2	1	1	1	1	9
NO	DEXMED	2	2.00	3	2	1	1	2	1	10
NO	DEXMED	2	2.00	1	2	1	1	1	2	8
NO	DEXMED	2	2.00	1	3	1	2	1	2	10
NO	DEXMED	2	2.00	1	2	2	1	1	2	9
NO	DEXMED	3	2.00	1	2	1	2	2	2	10